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- Planning a County Highway Shop
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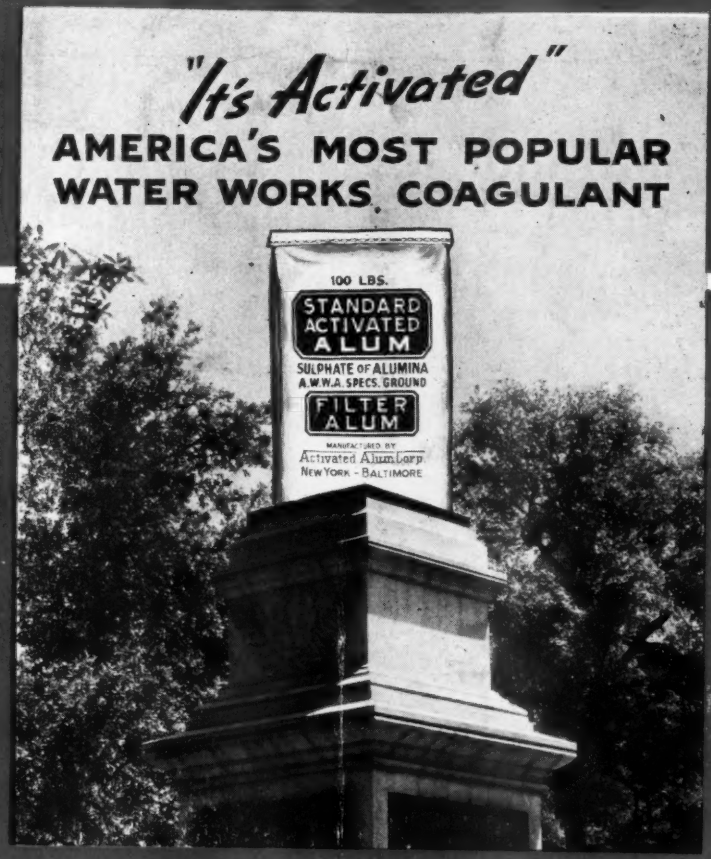

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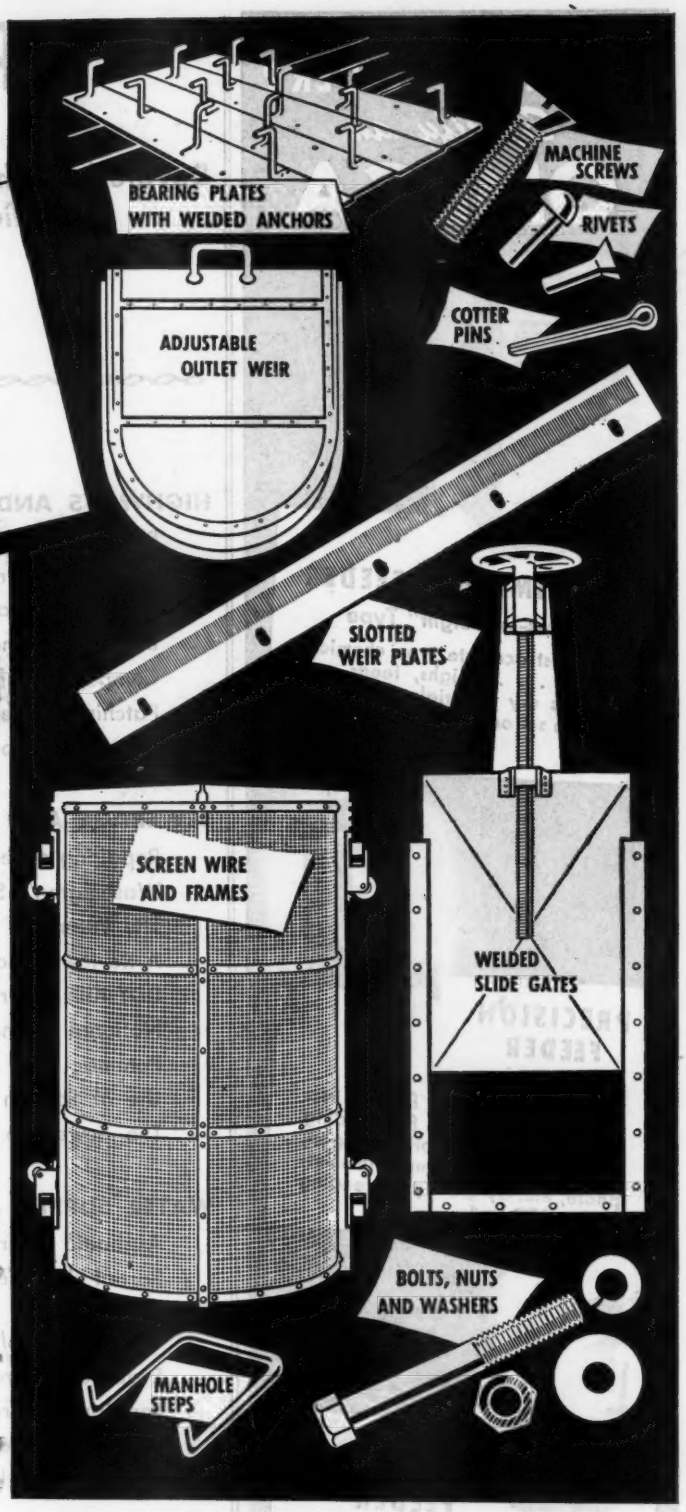

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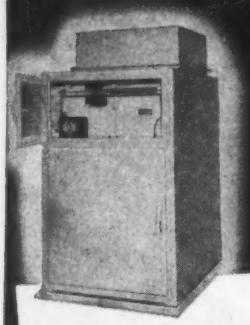

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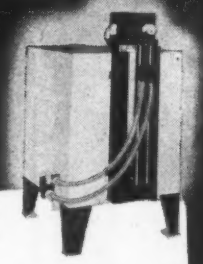

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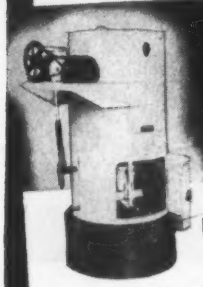

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Vol. 76 No. 12

A. PRESCOTT FOLWELL, Editor

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Asphaltic Reservoir Linings Prove Successful

Methods developed for waterproofing of California reservoirs show their values through more than twenty years of service.

By A. H. BENEDICT

The Asphalt Institute, Pacific Coast Division

ASPHALTIC linings for reservoirs and other hydraulic structures have been increasingly employed in the United States. In California alone nearly a million sq. yds. of this type of lining have given convincingly satisfactory service since the first one was placed in 1921.

Many of those asphaltic linings utilize road-oils mixed in place with aggregate taken from the material native to the banks, but the majority and the most satisfactory are composed of the highest grade of asphaltic concrete. Both types of construction have demonstrated the satisfactory nature and the economy of the basic design.

But while experience with the use of asphalt in hydraulic linings is not so broad as in highway construction, nor have the procedures to be followed in facing dams and reservoirs been so well standardized, the general picture of the use of asphaltic concrete for waterproofing hydraulic structures can be given in some detail.

A careful preliminary study should be made both of the site to determine its engineering possibilities and requirements, and of the material that will compose the bank. The conditions peculiar to each specific site demand special engineering and geologic investigation, and are no more to be neglected than the nature of the sub-soil conditions of a projected highway.

However, there are several conditions that can adequately be met by a more or less standard type of specification. Those are concerned with: 1. The slope of the side bank. 2. The type of soil upon which the waterproof blanket is to be placed. 3. The type of waterproof construction and the method of laying it.

Determining Slope of Bank

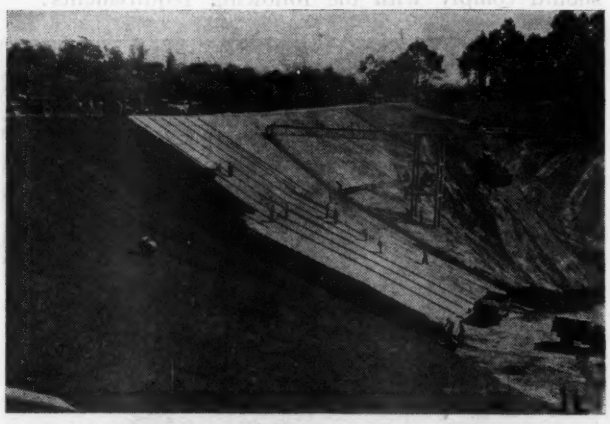
The designing of the slope of the bank will vary with each soil encountered. It can, however, be determined quite accurately by standard preliminary laboratory tests. The inside slope of the bank should not be steeper than 2:1, or preferably 3:1, where the low-cost types of asphaltic lining are used. For more stable types such as asphaltic concrete, slopes up to 1½:1 have been used successfully, but construction precautions must be taken that will assure that the underlying banks are firm and will not bulge or slump, and it is advisable to round the top and bottom of the bank.

Conditions and Characteristics of Soil

The pliability of the blanket should not be counted upon to overcome the cracking and settling of an improperly consolidated fill, or the movement of an underlying layer of earth. If the soil of the foundation is an expansive clay of the A-7 variety, its change in volume may warp and destroy the asphaltic concrete waterproof blanket. When this condition is found, all such areas should be blanketed with an adequate layer of granular soil or gravel. Specifications should always provide for consolidation of the foundation. Good practice calls for the construction and mechanical compaction of the entire sides and bottom of a reservoir or dam to at least 6″ above grade. This excess should then be removed to exact grade with a scraper. This precaution is to make sure that a smooth and firm foundation is secured for the bituminous lining.

At first glance this step may appear to be unduly expensive and unwarranted. But its cost can be reduced if the work be planned so that the material removed can be utilized in an as-yet-uncompleted grading operation.

The amount of mechanical work needed to prepare



Placing asphaltic concrete lining on Elysian Park reservoir.

the foundation for the asphaltic concrete water-proofing is minor in comparison to the work that must be done, for instance, to properly compact the sub-grade for a highway because the destructive forces acting upon a hydraulic structure are relatively small, but such compaction as is necessary is very important.

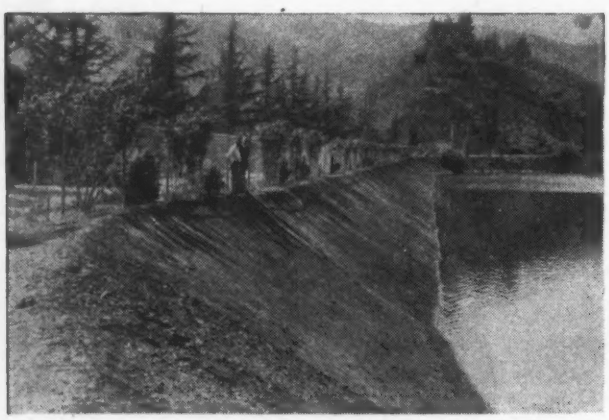
The type of soil encountered will also control the safe slope to which the reservoir banks may be constructed. The slope of a lined reservoir may prove more critical, however, than that of an unlined reservoir. Due to the hydraulic back-pressure developed in dense soils when water that has been held for long periods at a higher level is suddenly released, a tendency is created for the water in the bank behind the lining to drain into the reservoir, thus disturbing the previously existing hydraulic equilibrium, particularly behind the bottom third of the banks. This accumulated hydrostatic head, characteristic only of dense clay or silt soils, indicates the desirability of well rounding the banks at both the top and bottom, and keeping the slope of the bank between top and bottom at no greater a slope than the safe angle of repose of the soil when it is wet, though not saturated, unless saturation is the natural condition of the soil.

The soil underlying the lining must be sterile as regards weed growth. If the reservoir or dam is newly constructed and weeds have not started, and particularly if it is to be filled with water immediately, there is little probability of weeds appearing; however, the banks of an existing reservoir or dam should be sterilized. This may be done by mechanical destruction of the roots followed by the use of any one of several standard chemical weed killers, such as sodium chlorate or sodium arsenite, or by the latter alone if applied in sufficiently heavy doses.

Asphaltic-Concrete Lining

For reservoir linings or dam facings, a dense graded asphaltic concrete has proven superior, as a water-proofing blanket, to the mixed-in-place or simple surface treatment. By employing asphaltic concrete, the engineer is assured of the possibility of a closer control over ingredients, of the use of dry aggregates, and of greater uniformity and better mixing of the materials. Use of hot-mix asphaltic concrete also makes possible the employment of heavier asphalts, which give assurance that the film suurounding each particle of aggregate is thicker and therefore more durable. This makes for a longer life and a higher resistance to erosion by water.

Although many different specifications have been used successfully, in general the asphaltic concrete should comply with the following requirements:



Stone Canyon dam, lined with alternate layers of road oil and sand.

Sieve	Percent Passing (by weight)
No. 3	100
No. 10	65-80
No. 40	30-42
No. 80	17-26
No. 200	8-14
Asphalt (85-100 penetration)	8-10

The asphaltic mixture should be relatively rich, as is recommended above. The voids in aggregate meeting the above specification are almost completely filled and each aggregate particle is coated with a thick film of asphalt. Resistance to infiltration by water is at its maximum, and the life of the mixture is correspondingly increased. Rich mixtures may be used safely, since the lining need resist only plastic flow down the bank and stability is not, therefore, of primary importance.

A somewhat coarser aggregate may be employed than that described above; but the texture of the surface of the finished work must be smooth, so that wave action will not wear away the matrix from between the coarser particles.

Where the aggregate employed in the asphaltic concrete is so coarse as to call for a surface treatment to improve its texture or prevent leakage through it, a seal coat is desirable. Such a seal coat should consist of an application of RC-3, SC-5 or 200-300 penetration asphalt, and be covered with sand. Where absolute impermeability is sought under substantial hydraulic heads, a heavy mop-coat of hot mineral-filled, air-refined asphalt (commonly known as "asphalt enamel") will generally prove successful.

If it is uneconomical to use asphaltic concrete, a mixed-in-place construction can be employed. It is somewhat cheaper, requires less equipment, and while it is not as dependable, if surrounding conditions are favorable and the process is carefully inspected it makes a very satisfactory substitute. In any case, if mixed-in-place construction is used the layers should be thicker; and, it should be protected and waterproofed by a heavy sand-seal coat, or by a coating of asphalt enamel. The natural aggregate found at the place of construction should be carefully examined for its quality and gradation. In case the material selected as the coarse aggregate contains particles over one inch, a dense, smooth surface should be obtained by a sufficiently heavy seal coat.

Whatever type of construction is adopted, the aggregates to be used should be tested in order to be sure that their water absorbtion index is low, and that prolonged immersion in water does not affect the adherence of their asphalt coatings. In making specimens for the immersion test, care should be taken to see that the method and temperature of mixing, and the moisture content of the aggregate follow as closely as possible those which will be employed in the actual construction. Hardness of the aggregate is important only where severe erosion is expected.

On the theory that failures caused by undercutting would be localized, wire-mesh reinforcing has been used on some jobs where there was need for strength, such as those subject to the possible impact of logs or heavy boulders. Such conditions are not met with in lining reservoirs or dams, however, and for this, reinforcing usually is actually detrimental.

Several different methods have been followed in the work of placing the waterproof blankets, all of which have given satisfactory results to a greater or less extent. In this article no attempt will be made to de-

scribe all of these, but a few examples will be cited which will broadly cover the wide range of methods employed. In describing each example, the features peculiar to it will be noted.

Linings Mixed In Place

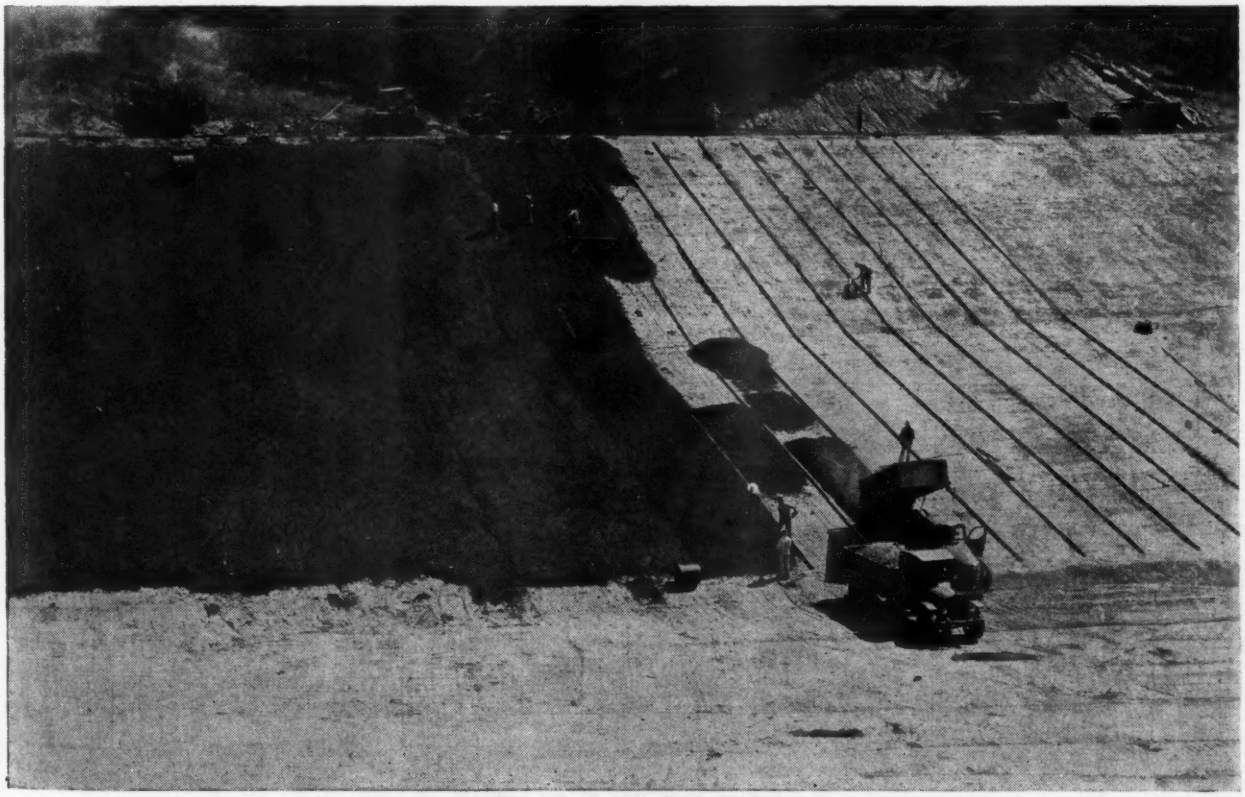
Mixing the natural soil, found in place, with an asphaltic road oil was perhaps the first method employed. In 1922 or 1923 the first of two Vale Ranch reservoirs situated in extreme Southwestern California was lined by mixing in place, to a depth of only 1½ inches, the granite sand found there with a liquid asphalt of the SC-2 grade. After compacting with a hand roller, the lining was sealed with SC-5 and a cover of fine sand was placed. This lining was constructed with a high percentage of asphalt, and is still in good condition due, probably, to this fact. There has been very little weed growth through the lining, probably due to the reservoir having been kept completely filled with water for several years after its completion. The other reservoir at this ranch, constructed in 1937, was lined with a similar mixture, but the blanket was 3" thick and sealed with 150-200 penetration asphalt and a light sand cover. This lining is disintegrating, evidently because the mixture was too lean.

In 1924 the Stone Canyon dam was constructed, the upper 60 feet of the upstream face of this dam being given a mixed-in-place asphaltic lining 6" thick. After completion, the design of the dam was altered and a core trench was constructed along the top, and the material from this trench was dumped onto the asphalt lining of the upstream face of the dam. This new surface was then blanketed with alternate layers of light road-oil and sand to a depth of 4 to 5 inches and rolled. This method of construction is not recommended, but only one large horizontal crack has developed, which was filled with asphaltic mastic, and the dam has stood up remarkably well.

In 1929 the Sawtelle reservoir, near West Los Angeles, was lined with 3" of the natural soil mixed in place with SC-2 and sealed with a heavy coat of 150-200 penetration asphalt and sand. The existing bank material at this location, which was quite well graded from one inch to dust, was scarified deeply enough to loosen sufficient material for a 3" lining, and was thoroughly harrowed both to eliminate lumps and to kill all weed growths. SC-2 liquid asphalt was applied with continuous mixing by harrowing and discing, until a total of two gallons per square yard had been incorporated. The layer was smoothed and compacted by the front wheel of a tandem roller, which was dragged by a cable running over a hoisting winch in a truck on the top of the bank. Then the surface was sealed with two applications, each of ½ gallon per square yard, of 150-200 penetration asphalt, followed by sanding. The only maintenance work done to date has been the patching with premixed asphaltic concrete in 1935 of a small area at the water line where the underlying bank had caved in. At the present time the lining is in need of a "refresher" seal coat above the water line to remedy surface oxidation checking.

The reservoir of the City of Arlington was lined in 1930 with 2" of the natural soil mixed in place with SC-2, followed by a ½ inch penetration-type surface treatment. The natural soil was a well-graded, disintegrated granite, running from ½ inch to dust. This was scarified to produce sufficient material for the 2" blanket, and then thoroughly harrowed to prevent weed growth. Liquid asphalt was applied in small increments to give a total of 1¾ gallons per square yard. The surface was mixed thoroughly with discs and harrows and then compacted with a roller operated as in the case of the Sawtelle reservoir. A ½ inch seal coat was then applied. In 1936 a seal coat of ¼ gallon of 200-300 penetration asphalt per square yard, covered by clean sand, was applied, although it

(Continued on page 36)



Placing and rolling asphaltic concrete lining on Elysian Park reservoir.

Planning A County Storage and Repair Shop

By M. J. ROIDT
Highway Commissioner of Vernon County, Wisconsin

VERNON COUNTY, Wisconsin, contains a total of 1591 miles of road, of which 188.5 miles are State roads, 253 miles are County trunk roads, and the remainder are town roads. We maintain all the State and County roads, 441.5 miles, both summer and winter, and remove the snow from 690 miles of town roads. The snow removal is by far our hardest job.

To house and maintain the equipment which we use for this purpose, we are constructing a storage building and repair shop which we hope will be large enough to handle our snow removal equipment for years to come.

Before preparing any definite plans for this building we visited many counties which had built shops in recent years, from which we got much information and many data that were very helpful in laying out and planning our own shop.

The county owns a lot in Viroqua, which is well located in the center of the county, the lot having nearby rail and truck service. We started our planning with a rough pencil plan that would fit this lot. With this first plan we were able to visualize our floor arrangement for both size and convenience. We then submitted these sketches to our architects, Law, Law, Potter & Nystrom of Madison, who gave us many good pointers on changes in arrangement and materials. They prepared sketches and sent them to us for suggested changes. These, when decided upon, were incorporated in the next set. Six sets were prepared in all, and we then had the plan that we will use in our building, except that we have decided to change from a stoker-fed coal boiler to an oil burning furnace.

The building is 82 ft. 8 in. front by 254 ft. 7 in. deep. It has streets on the west, south and east sides. Near the center of the north side is an extension 20 ft. deep by 70 ft. long in which are located the boiler room, fuel room and lunch room. The east 32 ft. of the building is two-story and is devoted to offices and stock rooms. Thus our entire highway force, including the commissioners, will have its headquarters in one building.

We have never visited a county garage that had sufficient space for all its grader blades, tires and large repair parts, which had to be stored elsewhere. Under such condition it is impossible to keep an accurate perpetual inventory, which we believe is very necessary where one has large parts inventories. Our equipment storage room is 141 ft. by 82 ft. The repair shop is 81 by 84 ft. The ground floor stock room is 50 by 30 ft. and the parts stock room on the second floor is 33 x 30 ft.

In the northeast corner of the repair shop will be a Weaver twin-post, heavy-duty lift which will be flush with the floor when not in use. There are two street entrances to the shop, each 18 ft. wide, with electrically operated overhead doors. The shop is separated from the storage area by a brick wall, in which is an electrically operated overhead door 20 ft. wide. In the southwest corner of the shop we will have a lathe, milling machine, presses and other power machinery. This space, as well as the rest of the shop, will be fully wired for both 220 and 110 volts.

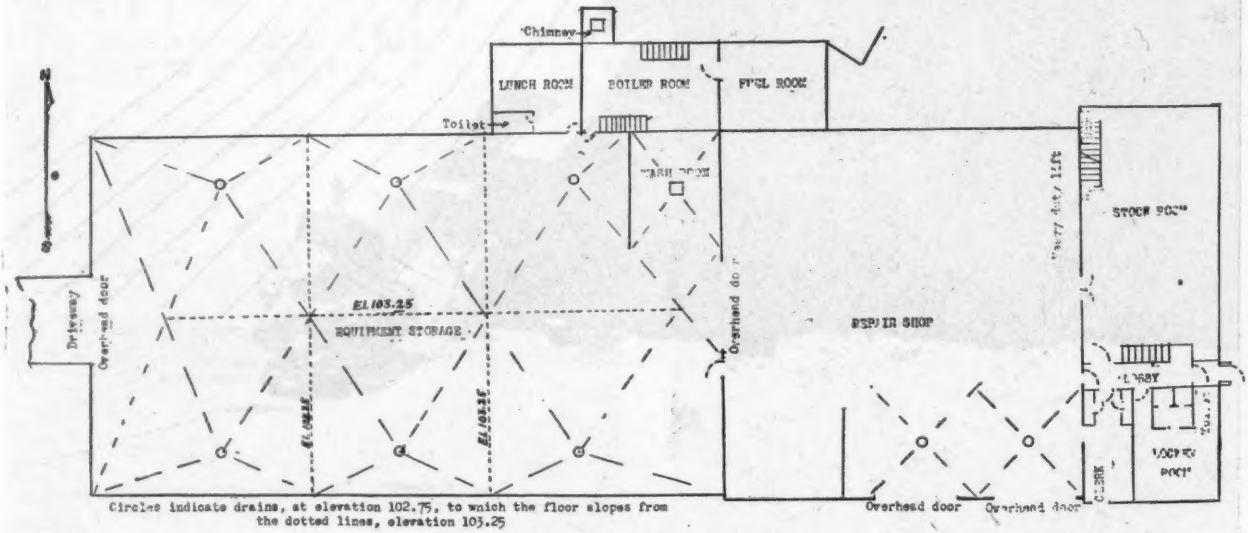
Fluorescent lighting will be used throughout the entire building. Heating is to be effected by themostatically controlled units installed near the ceiling. Ventilation will be through manually controlled wall units.

The storage area will have 12 ft. side walls and a gable roof. This gives us plenty of ceiling height for any of our equipment. In our trips to other shops we found many storage rooms with a full 20 ft. ceiling, which looked like a lot of unnecessary space to heat. The floor of the storage area is 6 in. concrete. Entrance from the street is through a 20 ft. overhead door.

The offices, on the second floor, are separated from the shop by two walls, which are expected to keep out the noises. The floors of the offices will be of asphalt and ceramic tile. The ceilings will be acoustical.

The outside walls are to be of cream-colored brick with limestone trim. The inside is of tile and brick.

Lighting is provided by windows, which occupy more than half the entire area of the outside walls.



Ground floor plan of the building.

Repairing a Sewer Laid in Quicksand

This 21-inch sewer, laid in sand with ground-water level five feet above the invert, had settled a maximum distance of 3.25 feet and was badly cracked. Reconstruction necessitated use of well points for dewatering the trench.

By RICHARD G. COULTER

THE following is a description of the work involved in repairing fifty-seven feet of a 21″ sewer that had failed by settling. The municipality for whom the repair was made had no construction records, so reasons for the failure can only be inferred from evidence gathered while making the repair.

Before starting operations at the break, an auger boring was sunk in undisturbed ground about 20 feet from the center line of the sewer. The boring logged five feet of clay, twelve feet of fine sand and silt, and eight feet of fine red sand; below which the sand was so compact that the auger could not be driven further. Ground water was located 12.5 feet below the surface or about five feet above the normal invert of the sewer.

The sheeting used in the original construction had been driven in two stages, the top set 10 ft. wide, the lower set 5 ft. wide. All the sheeting had been left in place, but not the braces. The sheet piles in the upper stage were in good condition and new braces were placed as the excavation proceeded. The sheet piles in the lower stage were in such poor condition that they were pulled and replaced with new.

Excavation was made with a crane and clamshell bucket. When the ground water was reached, twenty well points owned by the town were installed on the south side of the trench with the tops of their screens about 4½ ft. below the pipe, and placed in operation using a 4″ diaphragm pump. These made practically no progress against the water, so twenty-five well points and a 6″ pump were rented and installed along the north side of the trench with the tops of the screens about 7 ft. below the pipe, the header pipe 18.2 ft. higher, and the pump suction 7.5 ft. above that. This set-up lowered the water about two feet, or to a level 3 ft. above the sewer invert.

The town's well points were then re-jetted to the same depth as the others and the 4″ diaphragm pump was removed and the headers for the two sets of well points were connected so that the 6″ pump operated all the well points; and this pump was placed in the excavation with its suction level with the header pipe. This arrangement lowered the water table to 0.4 ft. below the sewer invert.

Not being satisfied with this removal of the water, sounding was made with a long well point. This checked the auger boring but revealed a change of material at a depth of 34 ft. The porosity of this stratum was so high that the wash water was absorbed as fast as it could be supplied. Following this, sixty more points and another pump were rented. Thirty points were placed outside the first set on the south with top of screen at elevation 4 ft. below the others. The yield was then so good that only fifteen were added on the north side and the water table was brought down to an elevation 4.5 below the invert.

The pipe and cradle were removed from Sta. 7 + 28 (where a bulkhead across the trench had been found in place) to Sta. 7 + 85. From 7 + 28 to 7 + 31 the pipe was cradled to the springing line with 6″

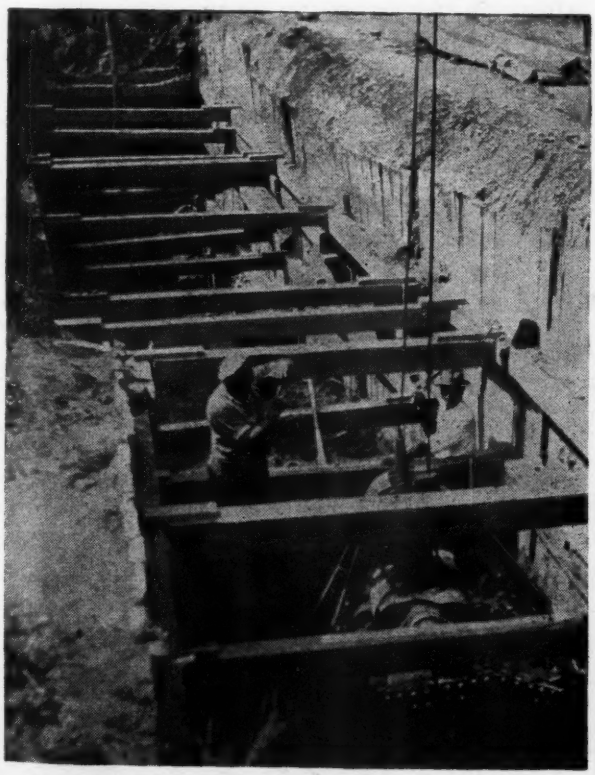


Fig. 1—General view of excavation. Upper set of sheeting with new bracing in place.

Fig. 2—Lower set of sheeting uncovered. This was pulled and replaced before uncovering the pipe.

Fig. 3—Pipe and cradle as found at Sta. 7 + 28.

of concrete and 18″ of gravel below the invert. Beyond 7 + 31 concrete extended from wall to wall of the trench from 6″ to 14″ thick *over* the pipe, but no concrete was found under it.

Starting from a crack and slip at Sta. 7 + 38, the pipe had settled progressively to a low of 3.25′ below plan grade at Sta. 7 + 52, then sloped upward, at a decreasing rate, to plan grade at Sta. 7 + 82.

In the section between Sta. 7 + 34 and 7 + 55, each pipe was badly cracked longitudinally, transversely and diagonally; from 7 + 55 to 7 + 82 cracking was chiefly longitudinal at top, bottom and springing line, with occasional diagonal or transverse cracks corresponding to transverse cracks in the concrete.

The cradle was cracked on the center line from Sta. 7 + 50 to Sta. 7 + 83 and transversely at Stations 7 + 38, 7 + 50, 7 + 52, 7 + 64, 7 + 67, 7 + 73, 7 + 76, and 7 + 83. The concrete was generally hard and dense but contained mud seams and patches of loose stone.

Additional evidence that the original contractor had trouble in this section is presented by the broken pipe found beneath the one being removed at Sta. 7 + 72 and continuing to the end of the repair, as shown in Fig. 5.

After removing the old pipe and cradle and all loose material, the trench was brought up to subgrade with run-of-crusher stone compacted by flooding. A 12″ reinforced concrete mat then was placed over the entire open area and allowed to set. New pipe was placed in a cradle extending from wall to wall of trench, 6″ thick on the mat and 3″ over the top of bells. The cradle cured for 48 hours before backfilling the trench. In backfilling, care was taken to leave no voids behind the sheeting. When ten feet of cover had been placed over the pipe, the well points were shut down and removed.

Why this sewer failed can only be surmised. Mud seams and groutless patches in the concrete, and sod and jute found in the old sheeting indicate a fight with water. A fifteen-foot backfill on an inadequately cradled pipe is sufficient to crack it. Due to the profile assumed in settling, all joints were pulled at the top and tight at the bottom in the section repaired; however, inspection of the adjoining sections showed some poorly seated pipes. Fine sand under hydrostatic head can enter a leaky joint or cracked pipe, and when the foundation is gone the pipe settles.

The cost of the repair was $15,000.

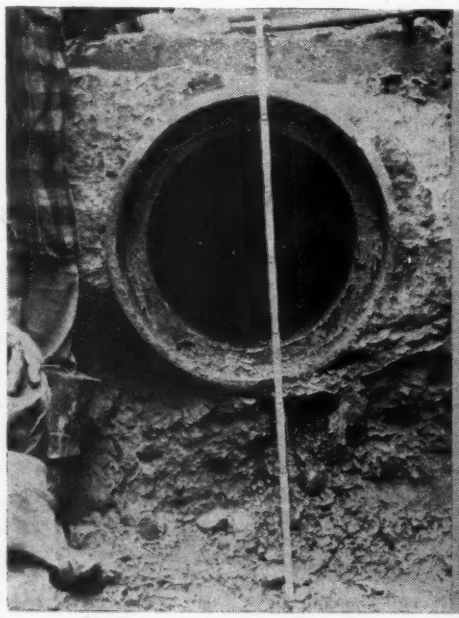


Fig. 4—Pipe and cradle at Sta. 7 + 37.

Fig. 5—Pipe and cradle at Sta. 7 + 78.

Washington's State Pollution Control Commission

The "Washington State Pollution Control Commission" Act, passed by the 1945 legislature of that State, established the existing cooperative Commission on a statutory basis. The new Commission is given authority to determine when pollution exists and is provided with necessary legal machinery for prosecution of violations.

Pursuant to the provisions of the Act, the Commission has adopted Rules and Regulations which require approval of plans for public sewerage systems and sewage treatment plants, and which state restrictions placed on disposal of sewage, operation of plants, use of sludge etc.

This commission works in cooperation with the State Department of Health, and each of them must receive a copy of proposed plans. The health department is looked to for technical advice and approval, but the legal approval and permit are given by the commission. "The State Department of Health will issue from time to time the general requirements concerning submission of plans, necessary data, design details, etc."

Apparently all operations connected with the construction and alteration of sewerage systems and sewage treatment plants must receive "the written approval of the State Pollution Control Commission."

Operation of sewerage systems and treatment plants must meet with the approval of the State Director of Health, and the Commission apparently has no direct control over the operation of any of them except as this may include alterations and changes in either system or plant.

The Future of Sewage Treatment

A number of forecasts by engineers, educators, operators, manufacturers and editors. One project is to establish hundreds of health units distributed over the entire country.

UNDER this heading the New York State Sewage Works Association has published, in its fall "News Broadcast" (the Association organ), a number of forecasts and other discussions of the subject indicated. The authors of these included C. A. Holmquist, representing the State Dept. of Health; Prof. E. J. Kilcawley, representing the educators; Morris M. Cohn, representing the technical editors; W. A. Darby, representing the manufacturers; M. H. Klegerman, representing the designing engineers; Edward J. Smith, representing the operators; and closing remarks by the editor, A. W. Eustance. A few of the paragraphs in this symposium which interested us most are quoted below.

In a recent report, the American Health Association's Committee of Local Health Units for the nation points out that "40 million of our population are still living under sub-standard local health organizations, ill equipped to give basic health protection." To alleviate these conditions and to reach higher attainment in the prosperous and congested areas. Dr. Emerson's Committee proposes the establishment of 1197 adequately staffed health units to cover the entire country. This proposal, including specific areas for the units has been approved in principle by the health departments of all but two states. The Committee on Professional Education is undertaking the task of accrediting schools of public health, and will, as soon as practicable, give consideration to requirements for "specialized degrees in engineering and other fields related to public health." These efforts will eventually result in adequate public health education and will establish the definite and important place of environmental sanitation in the over-all plan.—*E. J. Kalcawley.*

There will be a definite swing towards the utilization of sewage waste products—sludge humus and sludge gas. Similarly, it will become popular for industry to recover and utilize waste instead of discharging them into sewers or industrial waste treatment plants. A nation that loves to tell about utilizing every part of the pig but its squeal will look with favor on waste recovery.

The sewage treatment plant of the future, even more definitely than the plants of today, will depend upon mechanized processes, cleanliness of operation, and orderliness and odorlessness of the plant utility. The corollary to this is better trained operators, at better compensation, with employment security that will permit them to devote themselves unselfishly to their public health work.—*Morris M. Cohn.*

During the war there have been a number of processes used in sewage treatment which may result in the speeding up of treatment steps with consequent decrease in size of installations and lowering of first and operating costs. Some of the speeded-up processes will be somewhat more temperamental in operation than the older methods of treatment, with the consequent demand for a well trained operating personnel.

It is to be expected that better plant records will be kept in the future which will allow for closer evaluation of methods of treatment, with the establishment of more accurate yardsticks for design purposes. Assembling of such data will find particular use in remodeling existing plants. In many cases, the existing structures are being used to full advantage and the proposed additions closely coordinated. For remodeling or making additions to existing plants a combination of processes will be used in many instances.

The Federal Government is now reviewing, and tabulating, the records of a large number of the sewage treatment plants installed in military projects. Practically all of the usual methods of sewage treatment were used in these plants. The release of these data will afford much valuable data for future municipal work.

Many of the manufacturers furnishing equipment for sewage treatment plants have been busy the last few years supplying units for military installations. Also during this time, whether because of lack of usual materials, or for other reasons, they have redesigned their units. This redesign has resulted in better equipment for municipal and industrial use. At the same time, research has been done relating to more efficient utilization of digestion tank capacity, digester supernatant treatment, better settling tank design, dual fuel gas engines, thermophilic-mesophilic digestion combination, sludge heating methods, grease and scum separation and removal devices, screenings disintegrating units, improved oxidation treatment by diffused air and high rate filters, etc.

Sewage treatment as covered by the last 25 to 30 years has seen a rapid, and in the most cases, a healthy growth in the use of mechanical equipment. Even more mechanization will be used in the future. Attention must be given to durability of equipment to minimize maintenance.—*W. A. Darby.*

Joint municipal undertakings for solution of sewage treatment problems on a drainage area basis has been tried, proven effective and will probably be adopted to a greater extent in the future.

The future in waste treatment will be decided largely by intensity of research and development by agencies other than individual manufacturers. Certain industrial groups, as Paper, Textile, Food, and Oil have voluntarily established agencies and funds for necessary research and development of technical processes of waste treatment common to their respective groups. This is all to the good. More will probably be done in that direction in the future. The bulk of the work will, however, have to be supported by public funds and conducted in the University or Experimental Station where the required variety of personnel and facilities are more likely to be available than in the Engineer's office. The Engineer's place in the picture will be the working adaptation of such research findings to individual problems.—*M. H. Klegerman.*

To obtain real operating success radical changes must be made in the present conditions. There should be some controlling body with sufficient power, similar

to the schools and the State Board of Education, to remove the treatment plants from direct political interference. The plant operator should have sufficient salary which is in keeping with the services demanded of him. He should have a well paid staff, proper tools and equipment to work with. The following items are necessary.

1. State approval of budgets.
2. Sufficient salaries and wages to induce trained men to enter the field.
3. Educational facilities including refresher courses.
4. Sinking fund system of renewal of large equipment.
5. Opportunities to attend conferences and conventions to obtain new ideas and the current practices in other places.—*Edward J. Smith.*

We have been thinking of disposal of garbage by grinding and digestion, to be operated in conjunction with sewage plants. Why not incineration, a much more satisfactory job, requires less care (picking over material). Grinding of garbage may work if such garbage is ground in the home but garbage reaching a plant contains glass, bottle caps and a good percentage of the so-called garbage must be picked out because it can't go in a garbage grinder. I think an incinerator should be a logical part of the future sewage treatment plant and can be used to burn sludge if the public doesn't use it for fertilizer.

Sludge should be used as fertilizer. Many communities are making a lot out of that and when the people are sold on the idea, the operator has no trouble finding a spot to put his dried sludge.

Schools for operators—we should have more and better schools. The school should come to the operator, or at least nearby because many of the operators at the small plants can't leave for three days or two weeks or whatever length of time the school runs. Assistant operators should be trained for every plant so the operators could get a vacation, get to meetings and some even die or quit. When that happens, in small places, he is or was the only man who could run the plant and his successor is lost for a long time on that job.—*A. W. Eustance.*

Resurfacing Gravel Road With Thin Concrete

THE Queensland Main Road Commission has experimented with resurfacing old gravel roads with a thin concrete slab; first giving it a thickness of 3 inches, and later, this having proved satisfactory, reducing it to 2 inches. Some of the details are given below.

During August and September 1940, an experimental section 1,000 ft. long was laid on the Brisbane Valley highway, an old, very hard gravel road which had been under traffic for several years. It had been constructed of sound river gravel mixed with a loam binder, which provided a good wearing surface except that it tended to develop potholes in wet weather and corrugations during prolonged dry periods. At the time of this experiment there was from 4" to 6½" thickness of gravel on the road. The cross slope varied from 1:24 to 1:60 and this was brought to an approximately uniform slope of 1:48. To do this with minimum disturbance of the existing consolidation, the pavement was soaked with water over night and bladed with a heavy power grader early the next morning and placed under traffic for a week. Some of the gravel used in the original construction was as large as 3", which made it necessary to do considerable hand trimming after the forms had been set to conform to the tolerance of plus or minus ¼ in. specified for the slab thickness.

The concrete was made 3 in. thick and 16 ft. wide, with a central longitudinal joint. There was no edge thickening. For a length of 880 ft. the slabs were made 10 ft. long, and for 120 ft. the slabs were 40 ft. long. The longitudinal joint consisted of a tongue projecting ½ in., 1⅝ in. thick at the base and 13/16 in. at the tip, with ½ in. dowels 12 in. long spaced 17 in. apart and welded to a ⅜ in. longitudinal reinforcing bar set 1½ in. in from the face of the tongue. The only other reinforcement consisted of ½ in. edge bars and radial corner bars. The transverse joints were not dowelled or keyed. No expansion joints were provided.

The aggregates consisted of screened river gravel between ⅜ in. and 1½ in., and sand. Five to 5½ gal. of water were used per bag of cement, including that in the aggregates. Test cylinders averaged 1800 lb. per sq. in. at 7 days and 2800 lb. at 28 days.

The outside forms were 3" x 1½" pine supported by stakes driven into the road. Alternate slabs were cast one day and the gaps filled in the following day. The concrete was tamped and roughly screeded with screed of 5" x 2" hardwood 12 ft. long, then tamped with a screed to bring mortar to the surface, and finally belted.

The cost was approximately 9 shillings per square yard for the 10-ft. slabs and 8 shillings for the 40 ft. ones. With adequate plant and normal conditions this could probably be reduced 18 to 20%.

Inspection of the work three months after it was completed showed that 3 per cent of the corners of the 10 ft. slabs showed cracks. In some cases the cracks extended right across the corner from a point on the central joint or outside edge, generally 2 to 4 ft. from the corner, to a point on the transverse joint a similar distance from the corner. In most cases the cracks did not extend right across the corners, but were only a few inches long. No trace of cracking could be observed in any of the 40 ft. bays. The cracks did not open up to any extent and were only visible on very close scrutiny.

There was a small amount of spalling in the central corners, but not to any serious extent. The traffic on this section from 1939 census showed an average of 153 vehicles per 12 hour day.

Recently 3200 ft. of road was covered with 3 in. reinforced concrete, 16 ft. wide, poured in 8 ft. x 20 ft. slabs; with transverse joints formed of 3 in. by ½ in. celotex saturated with creosote. Also 1700 ft. was constructed of 2 in. premixed concrete, without any reinforcement, compacted with a 2-ton roller and covered with 1 in. of bituminous surfacing. Another 300 ft. was laid similarly but without the bituminous surface. This last 300 ft. has shown considerable cracking, but the rest has been generally satisfactory to date.

Vinsol Resin Effects Inhibited by Heat

A study by Leonard Bean and Albert Litvin of the National Bureau of Standards indicates that heating cement containing vinsol resin to temperatures around 300°F will carbonize or volatilize as much as two-thirds of the air-entraining vinsols. The use of vinsol resins has been increasing rapidly because of the protection it affords Portland cement concrete against injury by freezing and thawing.

Repair of Flood-Damaged California Bridges

How the California State Highway Department repaired two bridges whose piers had been undermined by floods.

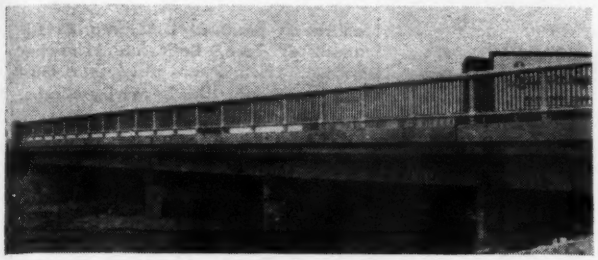


Fig. 1. General view of bridge over Poso Creek, Kern County, Calif. before flood of March, 1943.

Fig. 2. Dropping of deck, due to settlement of piers following excessive stream-bed scour.

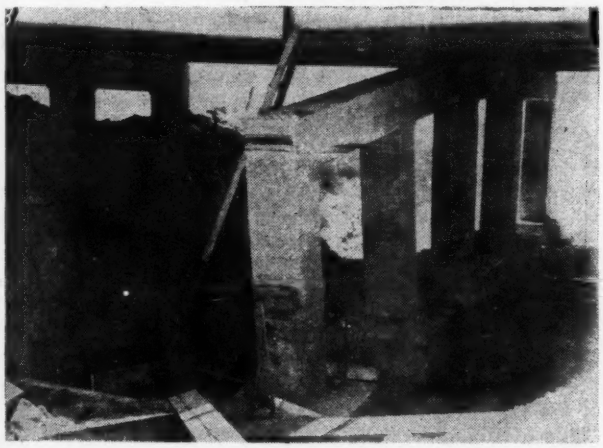


Fig 3. Showing closeup of piers that suffered worst settlement. Pier cap was cut, freeing two piers in foreground, which were straightened and extended by new concrete cap.

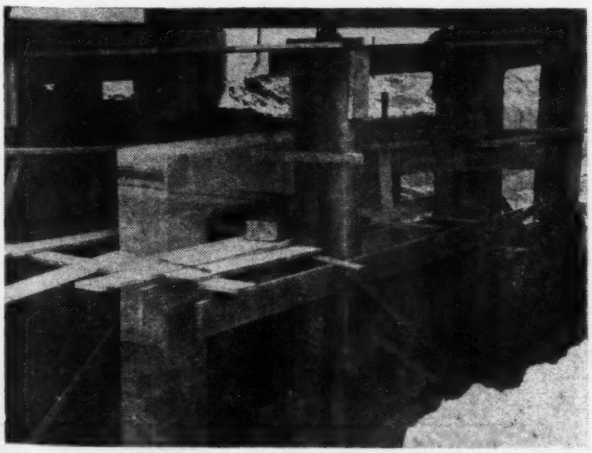


Fig 4. The two columns in foreground, after being separated from others, were straightened. The bridge deck was then jacked to proper grade.

Placing piers that have not been streamlined on the unstable bed of a stream running at unusually high velocities, will generally result in damage to bridge pier foundations even though footings be carried quite deep. The Bridge Department of the California State Highway System has had considerable experience with flash floods damaging their structures, particularly those designed before the true character of the existing data had been appreciated. The major failures, however, have been infrequent. Each case is considered as a separate problem in which the question presented is: Shall extensive repairs be instituted, or must the structure be redesigned and replaced?

Photos exhibiting the damage to, and repair of, two reinforced concrete highway bridges are shown herewith.

Figs. 1 to 5 illustrate the damage to Poso Creek Bridge (located in Kern County on U. S. 99 about 20 miles north of Bakersfield) by the heavy floods of March, 1943. The heavy scour brought about by the flood caused three out of five bents to settle, and drop

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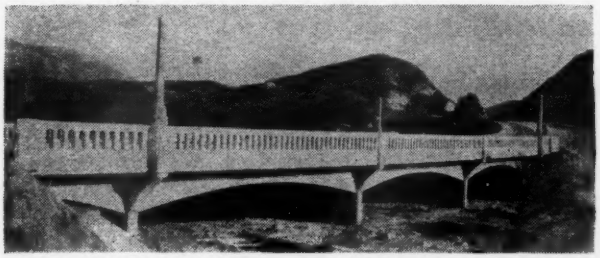


Fig. 5. Big Tajunga Bridge on Foothills Blvd., Los Angeles, Calif., before flood of March, 1938.

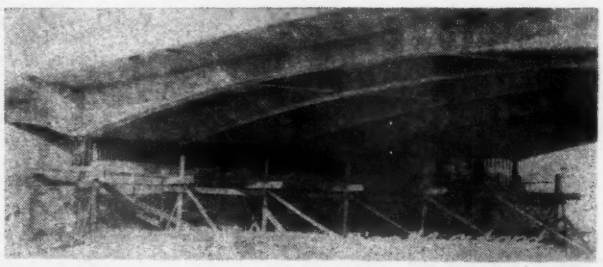


Fig. 6. Concrete at pier stripped from reinforcing steel. Eight mechanical jacks distributed under girder to bring deck back to grade. Removed concrete was then replaced after reinforcing steel was lapped.

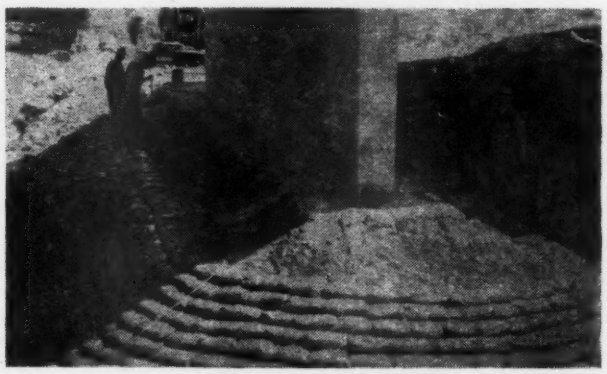
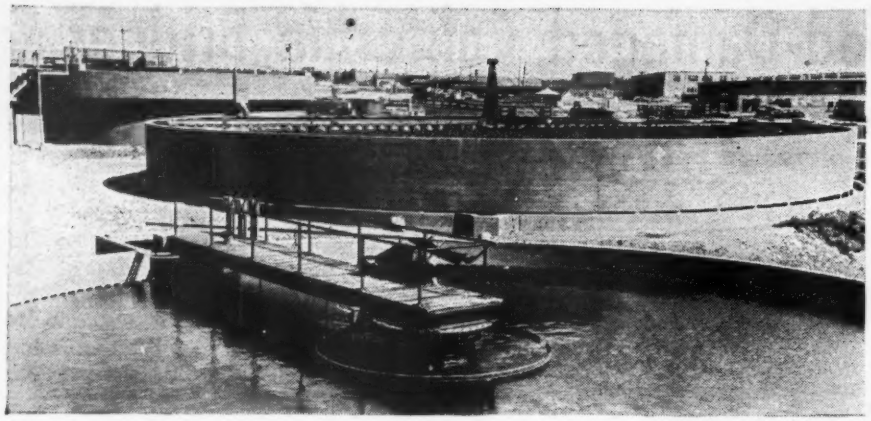


Fig. 7. Washed out footing at damaged pier was protected with mat of concrete in sacks.

A Review of So



Biofiltration plant at U. S. Marine Air Station, El Toro, California, showing Dorr final clarifier and distributor. Official photograph, U. S. Marine Corps.

DURING the course of the war, the Army constructed some 400 sewage treatment plants to serve military installations in the United States. Many more were constructed overseas, but few of these were of the modern types used almost exclusively in this country. The need for a high degree of treatment rarely existed at overseas bases, due to the general low level of sanitation abroad, exclusive of the European theater.

The approximate percentages of the various types of treatment plants built and operated to serve Army installations in the U. S. are indicated in the following table:

Imhoff tanks only	18.0%
Sedimentation and separate sludge digestion	6.0
Activated sludge	3.0
Aero-filters	1.0
All other filters	60.5
Chemical precipitation	0.5
Contact aeration (Hays)	11.0

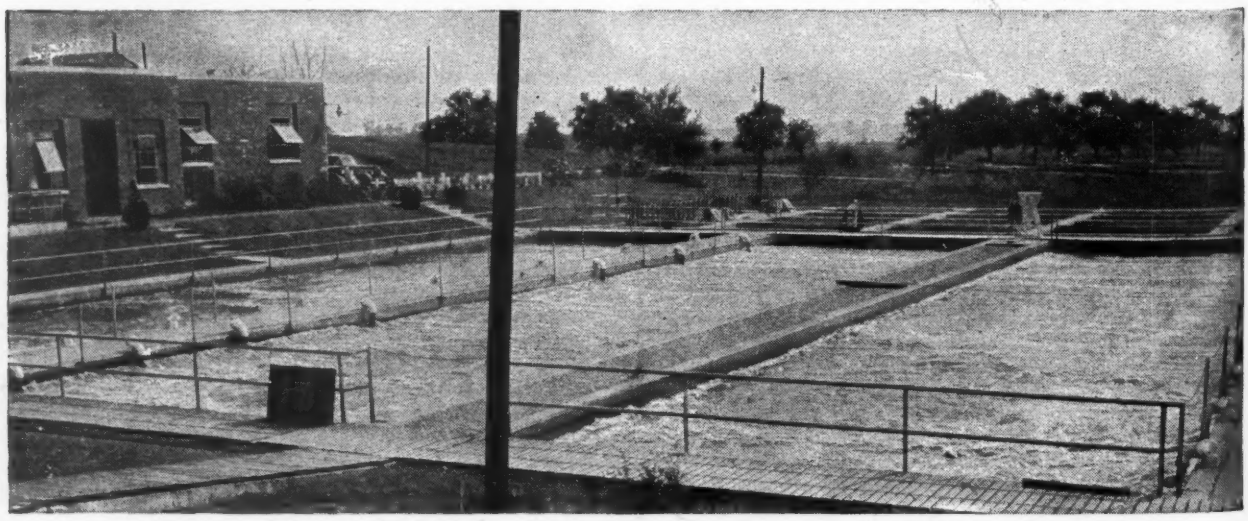
These figures do not include small septic tank and similar installations.

As far back as the spring of 1941, the bases for a sound solution of waste disposal problems were established by a series of conferences between the sanitary engineers of the Construction Division of the Quartermaster Corps and the Sanitary Engineering Division of the Medical Department. By Army regulations, both of these agencies had responsibilities in waste disposal—the QMG for design, construction and operation, and the Surgeon General for matters affecting health or creating nuisance. Since it is apparent that health protection and nuisance prevention depend upon good design, proper construction and skilled operation, close and understanding relations between the two agencies were necessary. Bases of design and standards for operators were established by joint action, and the selection of the type and degree of treatment was also discussed jointly where any question arose as to what was needed.

The results of this cooperative program are best summarized in a letter to the Army from the Surgeon General of the U. S. Public Health Service, who, because of his close contact with state and local health officials, was thoroughly cognizant with conditions. The letter stated, in part:

> "It has been most gratifying to note the almost complete lack of complaints from state and local health authorities in regard to sewage disposal from Army establishments. Despite the urgency for expediting construction and the justification that might have been offered for by-passing normal procedures in development and subsequent operation of these establishments, the Army has made every effort to conform to the standards of stream pollution established by state and local authority.
>
> "The good will engendered by this policy has been of direct benefit to the Public Health Service in this as well as in other fields of public health interest. I am glad to have this opportunity to express to you the appreciation of the Service, and particularly that of the Sanitary Engineering Division, for the far-sighted policy the Army has followed in this matter."

In the early stages of the war, few data of value were available on which to base design of Army plants, both as regards volume and strength of sewage. In addition, the variations in flow from hour to hour were important in design. Another factor that was not anticipated caused even more trouble; with the accelerated expansion of the army, camp populations doubled or even tripled over original plans, seriously overloading many sewage treatment plants.



Sewage treatment plant at Camp Breckenridge, Ky. In the foreground, aeration with "Chicago swing diffusers."

Some Army Sewage Treatment Problems and Results

Various problems were presented by the 400 treatment plants at military installations—filter fly nuisance, overloading, underloading, dangers in use of sludge and many others. A committee of sanitary engineers is preparing a report on the design and operation of these plants.

In order to provide basic data on these points for future guidance, the chief sanitary engineers of the Corps of Engineers and of the Medical Department requested the Sanitary Engineering Committee of the National Research Council to initiate "a critical study and review of design and operation of sewage treatment plants in military installations." Dr. F. W. Mohlman of the Sanitary District of Chicago was selected as chairman of this sub-committee and Harold A. Thomas, Jr., assistant professor of Sanitary Engineering at Harvard University, was engaged to assist in the collection of information and the preparation of the report. The sub-committee included representatives of the Sanitary Corps, the Corps of Engineers, the Navy and the Public Health Services. Additional Sanitary Corps officers were assigned to aid in the work.

The objectives of the sub-committee, as established, were "to record experience, country wide in scope and under varied climatic conditions, with many processes of sewage treatment"; and to establish useful norms to guide in the solution of future problems, including flow and character of sewage, methods of analysis and control, performance of treatment processes, design of treatment units, training of operators, grease removal effect of reduction of water consumption, laundry wastes, roughing filters, oxidation ponds, and many other factors. In order to accomplish these objectives the committee made a critical study of 89 plants, as follows:

Imhoff	2
Primary sedimentation	10
Activated sludge	8
Standard filters	29
Biofilters	16
Aero-filter	4
Other high capacity filters	7
Roughing filters	8
Chemical precipitation	2
Oxidation ponds	3

The field work has been completed and the report is now being prepared. Publication is planned for March, 1946.

The local nuisances from filter flies in some of the southern plants, and the increasing appreciation of the remarkable qualities of DDT as an insecticide, resulted in the assignment to the Fourth Service Command Laboratory, Fort McPherson, Ga., of Capt. (now Major) John A. Carollo, Sn. C., with instructions to develop means of filter fly control. In a series of laboratory tests and cooperative experiments with the City of Atlanta, it was demonstrated that DDT is a remarkably effective agent for psychoda control. Application of DDT emulsion, at the rate of 1 ppm of DDT, 24 hours per day one day a week appears to accomplish very effective control. Application is best accomplished by feeding the DDT emulsion into the sewage just before it is applied to the filters, preferably in the siphon chamber. No unfavorable effects could be detected in the quality of the effluent nor on the life in the filter bed.

Many special problems in regard to sewage treatment arose during the course of the war. Patients suffering from schistosomiasis, a tropical disease, were concentrated in two Army general hospitals. These patients may discharge ova, which hatch into a free swimming form, called miracidea, which enter certain species of fresh water snails necessary for their final development into cercariae, which may affect man. It was doubtful if any snails in the United States are capable of acting as hosts for the development of the cercariae, but a study of sewage treatment needs was made to establish treatment policies in case of need. It was determined that primary treatment, filtration (by any type of trickling filters), and secondary settling, followed by chlorination sufficient to provide a residual of 0.5 ppm after 30 minutes, was effective in destroying the organisms.

As the military population of the camps in the United States decreased in 1944 and 1945, special studies were initiated to insure that sewage plants

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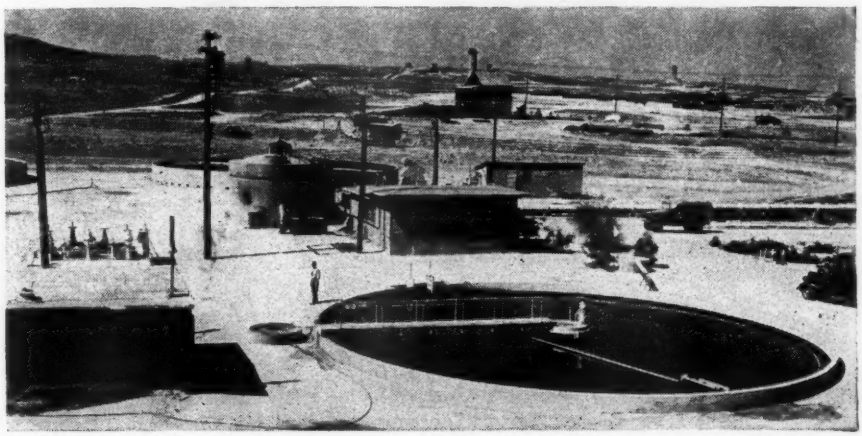


Sewage plant at Camp Haan, California. Includes bar screen, vacuator, clarifiers, biofilters and digester; all Dorr equipment. Photo by U. S. Army Signal Corps.

Partial Electrification of Plattsmouth's Pumping Plant

By ROBERT CAPPELL
Manager, Water Department, Plattsmouth, Nebraska

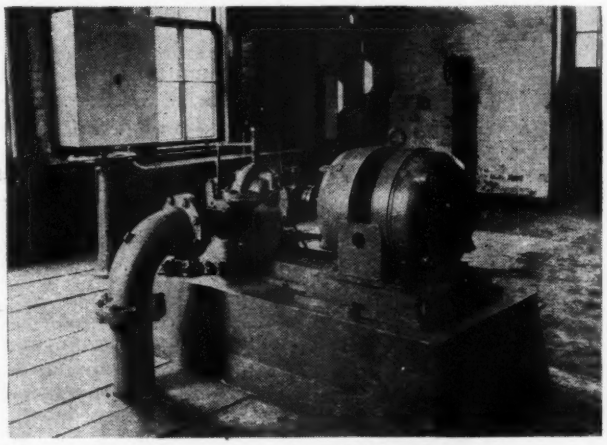
PLATTSMOUTH, Nebraska, on May 1, 1943, took over the water system formerly owned and operated by the Plattsmouth Water Corporation. The supply was obtained by means of wells, and was aerated through a contact bed, treated with lime and passed through sedimentation tanks and rapid sand filters, and pumped to a standpipe.

A 1 mgd steam pumping plant on the Missouri River about ¾ mile from the city raised the water from the wells, using a vertical triplex deep well pump fitted with an extended shaft which provided for rope drive, driven by a Laidlaw-Dunn-Gordon cross-compound Meyer gear engine. An old Blake pump, installed about 1886, was retained as an auxiliary until March, 1945.

The average consumption of water by the city is about 0.25 mgd except in June, July and August, when it jumps to about 0.60 mgd due to use by the canning industries. This is too near the capacity of the plant and we decided to provide increased capacity and to use electric power for driving a new 0.5 mgd pump; but to retain the existing steam plant as a stand-by and for peak pumping during the canning season. We expect to replace this also with electric pumping when we are in a better financial position to do so.

For increasing the capacity we purchased a centrifugal pump made by the American Well Works, size 3 x 2½ P.F., capacity 350 gpm against a head of 250 ft. at 3,500 rpm, operated by a 40 hp, 220 volt, 3 phase, 60 cycle motor, controlled by a Westinghouse magnetic reduced voltage starter. (The actual pumping head is 235 ft. when the standpipe is full). The pump is equipped with a Detroit temperature control to safeguard from overheating in case it fails to prime.

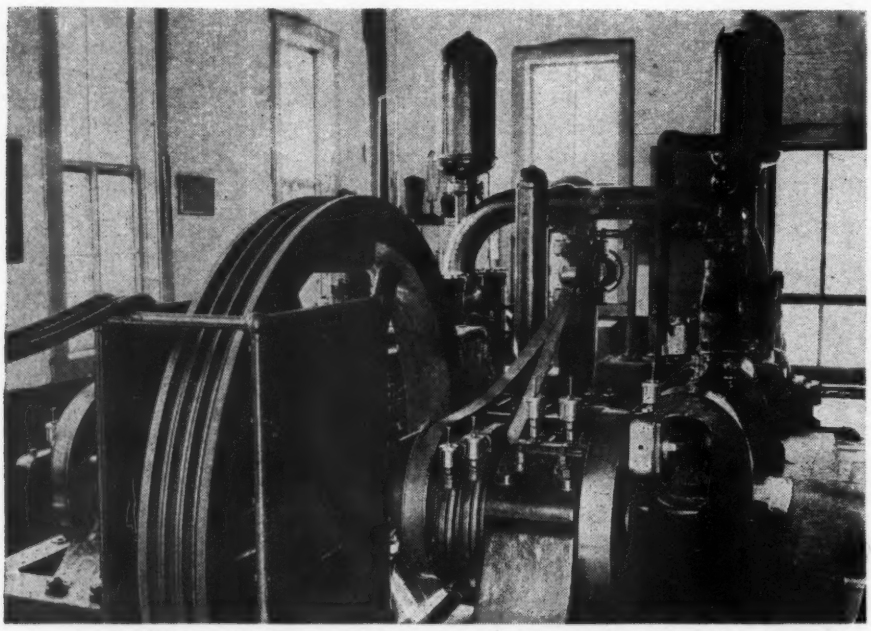
In order to maintain uniform pressure in the mains, the pump is completely automatically controlled by means of an E2 Tanktrol, using a 110 volt 60 cycle circuit for operating a telephone relay for 24 volts over a telephone circuit; the relay at the plant being



The 350 gpm American Well Works pump.

a Mercoid single-pole, single-throw, 24 volt, A. C., with 220 volt contacts. Such control of the main pressure was impossible with the steam equipment, which did not operate at night when the demand was low.

The switch board, service wires, entrance switches and other electrical equipment, all of Westinghouse make, are sufficient for handling another 500 gpm high-lift pump and also a 500 gpm deep-well pump.



The 1 mg Laidlaw-Dunn-Gordon cross compound high-lift pump.

With the discontinuance of the steam pumping engine, which has driven the triplex deep well pump, the latter was provided with a 15 hp motor, the 1155 rpm of which is reduced to the 62 rpm of the pump.

We now are equipped to pump the needed supply for nine months of the year by means of our 0.5 mgd electrical unit, and save the additional cost of operating a 1.0 mgd steam unit. The cost of coal for the steam unit and that of electricity for the electric unit are about the same per 1,000 gallons; but operation of the former involves extra cost of packing, oils, grease, repairs and labor.

We have just (in October 1945) let a contract to the Layne-Western Co. for a new 18" and 36" gravel-packed well and a 500 gpm electric pump.

Determining the Effect of Water on Bituminous Paving Mixtures

A test procedure for making such determinations as developed by the Division of Physical Research, Public Roads Administration, based on studies of various aggregates and bituminous materials.

IT IS well known that bituminous mixtures containing aggregates of certain types and characteristics are susceptible to the action of water and, as a result, many tests and specifications have been developed to regulate, or to eliminate entirely, the use of the more water-sensitive materials.

One of the most familiar water-sensitive materials is clay. Specifications governing many types of bituminous road construction require that the aggregate shall be free from clay, or that the aggregate particles shall be free from adhering films of clay. Other requirements for control of this material limit the plasticity index and liquid limit for the aggregate fraction passing a No. 40 sieve. Volume change is one manifestation of the presence of clay in a bituminous mixture, and a swell test has been developed and widely used as a means of control.

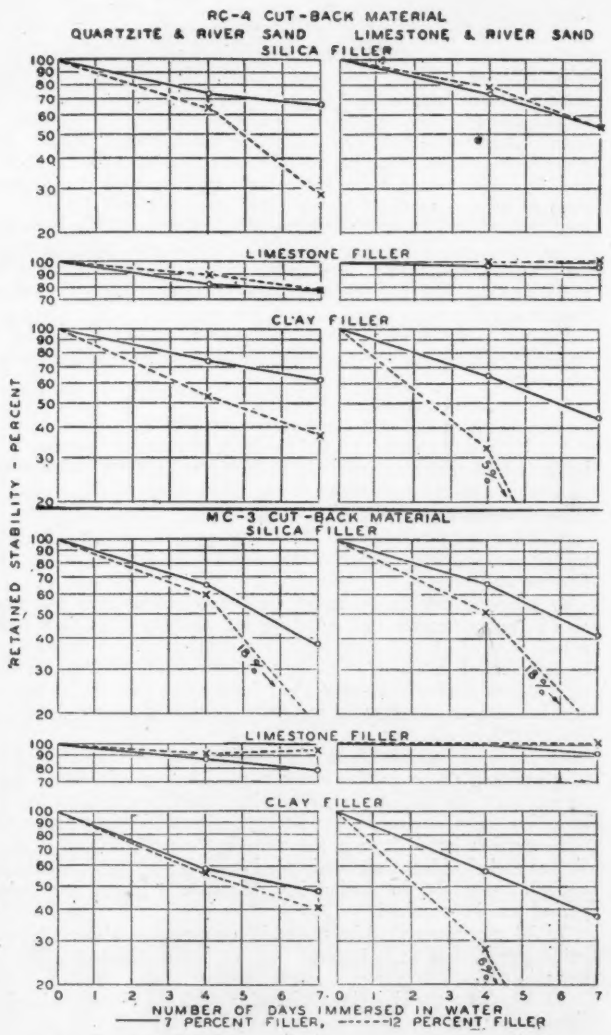
A different type of water sensitivity has been found to be inherent in the aggregate itself. This characteristic has been described as the preferential affinity of aggregate particles for bitumen or water when both are present. An outward manifestation of this characteristic is the propensity of the aggregate particles to retain or lose a bituminous film when exposed to the action of water. An aggregate that tends to retain a large percentage of bituminous coating under such conditions has come to be classed as *hydrophobic* and one that tends to lose a bituminous film as *hydrophilic*.

In order to test the hydrophilic or hydrophobic properties of aggregates, several tests have been devised, the most widely used being the Nicholson test, the Oberbach test and modifications thereof, various scrubbing tests, etc. Whatever the advantage peculiar to each of these stripping tests, there are several serious disadvantages common to all. First, only one size fraction of the whole aggregate is usually selected for test. Second, estimation of the extent of stripping is made by visual observation—a method seriously lacking in precision. Third, results of such tests give no indication of the actual degree of adhesion of the bituminous film to the aggregate particle. When the less viscous bituminous materials are used with certain aggregates, it has been observed that water will loosen or separate the film from the aggregate particle without, however, disturbing the continuity of the film. Failure of this type is not reflected in the results of the usual stripping test. Fourth, and most significant, there is no direct relation between the results obtained by any of the stripping tests and the effects that will be obtained when the complete bituminous mixture containing the aggregate in question is exposed to the action of water.

The Division of Physical Research, Public Roads Administration, has made a comprehensive series of tests, using different aggregates and bituminous materials, and developed a procedure for measuring positively the effect of the presence of water-sensitive materials of any type in bituminous mixtures when such mixtures are exposed to the action of water. This investigation is described in detail in a report by J. T. Pauls, principal highway engineer, and H. M. Rex, materials engineer, to Public Roads Administration and published in the recent issue of its journal, *Public Roads*. The following is a brief abstract of that report.

Three bituminous materials were used—an 85-100 penetration asphalt, and MC-3 cut-back asphalt, and an RC-4 cut-back asphalt. In all mixtures tested, the bitumen content was 6 parts of bitumen to 100 parts of aggregate, by weight.

Four types of coarse aggregate were used—a



Stability retention of specimens containing crushed stone.

crushed limestone (hydrophobic), a crushed quartzite (hydrophilic), a pit gravel (hydrophilic), and a river gravel (hydrophobic).

Three types of fine aggregate were used—river sand (hydrophobic), crushed limestone sand (hydrophobic), and crushed quartzite sand (hydrophilic).

Three types of filler were used—pulverized limestone, pulverized silica, and pulverized clay, all passing a 200-mesh sieve.

Some of the results obtained with different mixtures are shown graphically in the accompanying illustration.

The test procedure developed by these studies is described as follows:

1. The bituminous mixture for use in the test shall be composed of the aggregates, filler, and bituminous material in the proportions proposed for use in the actual construction. This is important, for it has been demonstrated that variations in aggregate, filler, or bituminous material result in corresponding differences in loss of stability.

2. Hot mixtures shall be molded immediately after mixing. All other mixtures shall be cured loose in air for 24 hours before molding. It has been found that such a curing period is necessary in order to obtain consistent results.

3. Cylindrical specimens 4 inches in diameter by 4 inches in height shall be molded under a load of 3,000 pounds per square inch by the double plunger method. Other means of compaction that will produce equally satisfactory results may be used. At least six specimens shall be molded for each mixture to be tested.

There is considerable diversity of opinion as to the proper relation of height to diameter of cylindrical specimens for compression testing. Some investigators hold that the influence of end effects may not be eliminated by the use of height-diameter ratios less than 2 to 1. Other workers report entirely consistent results with lower ratios when the specimens are tested between rubber disks. The importance of end effect in certain types of testing where absolute values are required is unquestioned, but, it is believed that for immersion-compression testing, where results are expressed in percentage of stability loss, the question as to the influence of end effects may be waived in the interest of convenience and practicability. In the development of the test procedures, several specimens 4 inches in diameter and 8 inches in height were tested under the same conditions and at the same time as other specimens of the same diameter and 4 inches in height. Although indicated compressive strengths of the two sets of specimens differed considerably, the percentage losses in stability checked quite well. The larger specimens were difficult to mold, and were much more susceptible to damage in the necessary handling incident to weighing and testing.

On the other hand, a specimen smaller than 4 inches by 4 inches would not be satisfactory for mixtures containing coarse aggregates.

4. All molded specimens shall be cured for 24 hours in an oven maintained at a uniform temperature of 140° F.

Freshly mixed and compacted roadway surfaces are immediately subjected to water action only in exceptional cases. Immersion of freshly molded specimens in the laboratory would result in greatly exaggerated effects.

5. After oven curing, the specimens shall be allowed to cool to laboratory temperature, then weighed in air and water for density and volume determinations.

6. Three of the six specimens shall then be tested in compression at room temperature after having been brought to a temperature of 77° F. in an air bath. The other three specimens shall be submerged in water at a temperature of 77° F. for a period of 4 days, after which they shall be removed from the water, weighed in air and water for moisture and volume determinations, and tested in compression.

In the work reported here, the specimens were placed on glass or aluminum plates in the water bath. These plates were found to be very convenient in preventing spalling or distortion in handling those specimens that became softened in the water bath.

Immersion for 4 days is recommended as productive of consistent and significant results in testing mixtures containing liquid asphalt materials. In testing hot mixtures, a longer immersion period will be required.

7. All specimens shall be tested in compression without lateral confinement, and at a rate of vertical deformation of 0.2 inch per minute.

This testing speed is in conformity with previous work of a similar nature.

It will be necessary to obtain much more data correlating service behavior with laboratory test results before test limits can be assigned for specification purposes. However, based on the work already done, it is believed that mixtures retaining not less than 75 percent of the dry stability after immersion for 4 days may be expected to have satisfactory resistance to water in service.

It is believed that an immersion-compression test, carried out in conformity with the suggested procedure, will produce information valuable in various phases of bituminous mixture design. The test is useful in:

1. Determining the effect of the use of hydrophilic aggregate, whether coarse or fine, on the stability of the mixture when exposed to the action of water. It is impractical to use the usual stripping tests in evaluating sands or fillers, yet results of the foregoing studies show the importance of fillers in the behavior of the whole mixture. It has been shown that satisfactory retention of stability may be developed in mixtures containing hydrophilic aggregate, provided suitable filler is used.

2. The selection of fillers with regard to their contribution to retention or loss of stability of the mixture in the presence of water.

3. The detection of aggregates that are structurally unsound when wet.

4. Determining the usefulness of additives in causing resistance to stripping of bituminous films from aggregate particles by water action.

5. Determining the minimum proportions of imported hydrophobic material required to reduce stability loss in the presence of water, in cases where local aggregate is found to be hydrophilic.

6. Testing aggregates considered for use in related types of construction, such as surface treatments. Although the primary value of the test is in the solution of problems in design of bituminous mixtures, it is believed that adaptations of the test would be useful in other bituminous work.

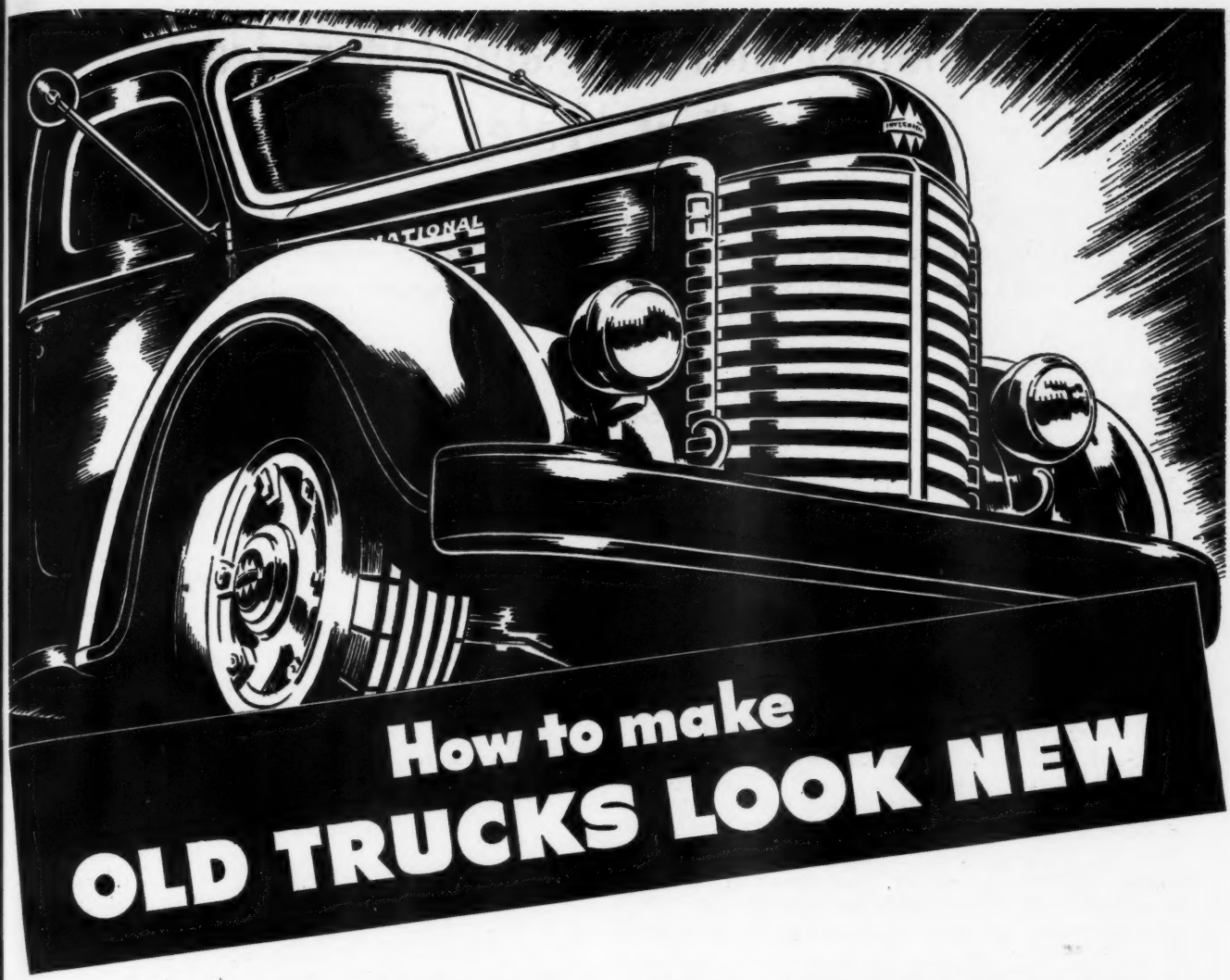
A Review of Some Army Sewage Treatment Problems and Results

(Continued from page 25)

would continue to operate effectively, even with greatly reduced flows. In general this was accomplished by cutting out surplus tanks to reduce detention periods and by recirculation to accomplish the same results and to maintain adequate flows onto filters. In some cases, programs of sewer flushing were carried out both to keep the sewers clean and to increase the flow into the plant.

Following the reports by various laboratories that the normal processes of sludge digestion and drying did not destroy intestinal parasites or their ova, consideration was given to the restriction of the use of sludges on parade grounds and commonly used grassed areas. The use of undigested or raw sludge was prohibited; air dried digested sludge was approved for use as a fertilizer for grasses, grain crops and shrubbery, except that in southern areas, where hookworm might be prevalent, composting of the sludge for four months prior to use was required.

Many other problems arose in connection with Army waste disposal problems, some of which can still not be described. The ones already enumerated indicate the wide scope of activities.



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Elimination of Tastes and Odors from an Army Post Water Supply

Algae in a reservoir, killed by copper sulphate, had settled to the bottom to form a black mud; the decomposition of which caused a serious taste and odor problem. Temporary and permanent remedies are described.

By LT. COL. F. H. STOVER
Sanitary Corps, U. S. Army

DURING the summer of 1945 an Arizona Army Post experienced a development of tastes and odors in its water supply of such an objectionable nature as to render the water almost undrinkable, and to cause some of the personnel to seek more palatable but frequently polluted water as a substitute. Local efforts being unsuccessful in remedying the trouble, assistance was requested of higher authority and the author was assigned to investigate the situation and recommend corrective measures.

The water supply of the Post is secured from three spring-fed reservoirs, designated as No. 1, No. 2, and No. 3 on vicinity map (Fig. No. 1). The respective capacities are: No. 1—24,000,000 gallons; No. 2—1,882,000 gallons; No. 3—599,000 gallons.

The No. 3 reservoir, the highest in point of elevation, and smallest in capacity, is of triangular shape, with concrete side walls laid on an approximately 30° slope, and with a concrete bottom except in the area where the spring is located. No inflow is visible from this spring as it enters below the surface of the water when the latter is at spillway level. This reservoir had been shut off from the rest of the system for about three weeks, and no accurate figures regarding the yield of this spring were obtainable. A 4″ cast iron line conducted the water from this reservoir to Reservoir No. 2.

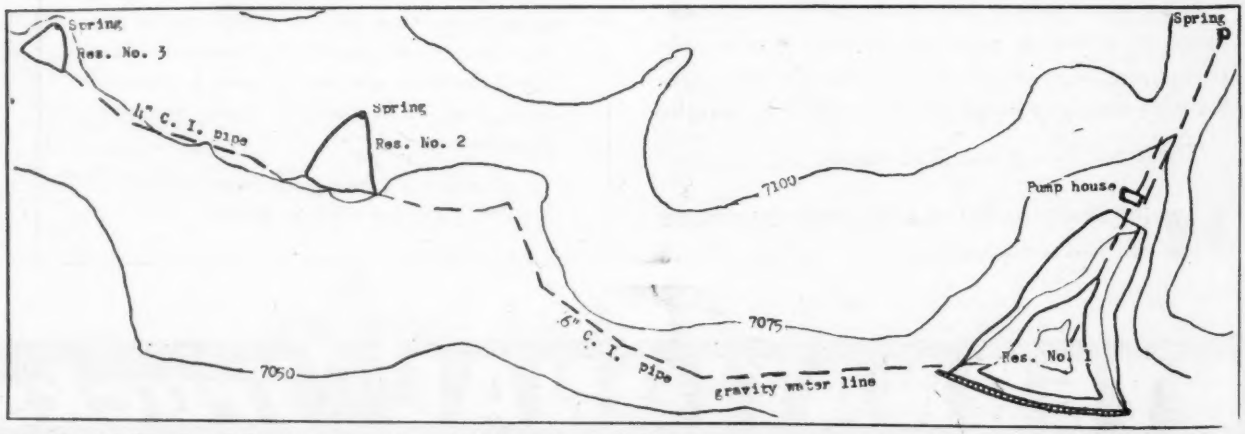
The No. 2 Reservoir, the middle reservoir of the system, is of similar construction to No. 1, with the exception that the entire bottom is concreted and the spring feeding this reservoir has its outlet about five feet above the spillway level of the reservoir and flows down a concrete valley in a corner of the reservoir. Due to the fact that there is no free fall, an accurate measurement of the flow was not possible at the time of inspection. It was roughly estimated at approximately one third that of the main spring feeding No. 1 Reservoir, or 16 gallons per minute. A 6″ cast iron line led from this reservoir to No. 1 Reservoir.

The No. 1 Reservoir, an open earthen type of irregular shape, is the largest and most important of the three, being between three and four acres in area and having a capacity when filled of 24,000,000 gallons. This reservoir has, as its principal developed feeder, a spring located about 300 yards northeast of the east end of the reservoir. A flow of 48 gallons per minute was measured at the time of the investigation. This spring has a free fall into a concrete manhole and flows through a 6″ cast iron line to the sump of a pump house located on the north bank of the reservoir. Two other springs also feed this reservoir, one on the east end from a different level than the one entering the manhole, and another originating along a spring seep on the west side of the reservoir.

A pumping station is located at the north end of the reservoir. The building is of brick 15′ x 24′ in plan and with a pump sump beneath the floor. This sump is eleven feet deep and carries a ten-foot depth of water, the surface level being the same as that of the adjacent reservoir.

The pumping equipment consists of three centrifugal pumps, one 250 gpm with electric motor; one 250 gpm with gasoline motor; and one 1000 gpm, electric with standby gasoline motor. Pumpage is to a 25,000 gallon elevated storage tank floating on the system. Average summer consumption was 170,000 gallons per day.

The intake line from the pump sump is laid along the bottom of the reservoir to a point near the south end, where it terminates in a concrete intake box



Map showing location of the three reservoirs and their springs and the connecting pipe lines. Also the 7050, 7075 and 7100 contours.

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located in sixteen feet of water. The inlet openings are screened and only slightly above the bottom.

An investigation of the quality of the water at various depths in the reservoir indicated a marked difference in the samples secured. Those collected at 13', 9' and 4' depths, respectively, showed improvement in quality toward the surface. The deepest sample was greenish yellow and quite odoriferous. The top layers showed a slight turbidity but little odor. Lines that dragged the bottom during collection of the samples came up fouled with a black sticky mud, indicative of bottom decomposition. The water in the pump sump had a particularly objectionable odor.

Extremely disagreeable tastes and odors were reported to have been recurrent in this supply during the summer months since activation of the post. The investigation of the tastes and odors present in the water indicated a condition frequently resulting from storage of ground water in open reservoirs, i.e., growth of various types of algae in the water, and subsequent development of disagreeable tastes and odors due to breakdown and decay of the organisms, and release of essential oils, present in minute quantities in their cellular structure. These tastes and odors constitute no direct hazard to health, and are not a cause of disease, but may become extremely disagreeable and cause personnel to seek better tasting but often polluted water from other sources.

Treatment of this water had been by ordinary chlorination, applied as the water was pumped from the pump sump. A Wallace and Tiernan chlorinator, solution-feed machine, with a top capacity of 16 pounds of chlorine per 24 hours, was in use. Chlorine application had been at the rate of approximately 2 ppm to obtain normal army residual of 0.4 ppm 30 minutes after application.

Further investigation indicated that this water was susceptible to treatment by "break-point" chlorination, in which stronger doses are employed to break down or "burn out" resistant organic matter of an objectional nature, in this instance obnoxious taste and odor-producing substances. Experimental treatments on a laboratory scale resulted in a product entirely free of the objectionable tastes and odors and with only a slight chlorinous taste present.

Application of this procedure to the supply of the Post gave results approximately in line with those secured in the laboratory, with the exception that slightly higher residuals were encountered at first. The laboratory residuals were 0.7 ppm thirty minutes after application; plant residuals ran from 0.6 ppm to 1.1 ppm, the latter figure being higher than desired or necessary, but considered as not being without benefit in clearing the distribution system and storage tank of remaining tastes and odors. Later adjustment of chlorine dosage to give lower final residuals was contemplated, but this proved unnecessary as after several days of operation lowered residuals developed without further changes.

The algal content of the water was practically zero at the time of the investigation, only a few broken down remnants of Diatoms, mostly Asterionella, being noted. There were also a small number of Crustaceans, mainly Cyclops. Considering the small number of organisms present, it was apparent that the repeated copper sulphate treatments applied to the reservoirs had largely eliminated the objectionable organisms previously present, but that their decomposition products had contaminated the water to such a degree as to render it extremely unsatisfactory for ordinary domestic use.

In order to obtain immediate relief without recourse to changes involving construction, the following modifications in operating procedure were put into effect:

a. The pump sump was drained and cleaned. Very little sediment was found in it however.
b. The intake line (drawing bottom water) was valved off from the sump and the spring northeast of the pump house permitted free fall into the sump.
c. A low lift pump was installed on the bank of the reservoir and provided with a float-supported suction line to permit taking of surface water, to make up the difference between what the spring could supply and the current demand. This water was delivered into the pump-house sump through an opened manhole in the floor.
d. The chlorine dosage was established at 6 ppm, which proved entirely satisfactory, resulting residuals after all changes were made being even lower than indicated in the laboratory tests, and the objectionable tastes and odors entirely eliminated.

In view of the fact that this post was considered a permanent installation, and that activity was expected to continue there, at reduced levels, during peace time, it was recommended that an accurate determination be made of the yields of the various springs and that, on the basis of these figures, a covered earthern or concrete reservoir be constructed, adjacent to the present pump house, of a size ample to care for the needs of the Post. Connection would be made from this reservoir to the present pump sump.

Small covered collecting basins were also recommended for each of the upper reservoirs, to receive the flow of these springs and discharge it immediately to the line leading to No. 1 Reservoir, where an additional main would be required to intercept the old collecting line near the south end of the reservoir and conduct the flow to the proposed covered reservoir. Open storage would thus be avoided and algal growth eliminated. Excess over current needs would be discharged into No. 1 Reservoir as a reserve fire supply.

Evaporation From a Storage Reservoir

The Water Department of Charleston, S. C., has since 1904 kept a daily record of the evaporation from its Goose Creek storage reservoir and from a land gauge located on the shore of the reservoir. A vessel approximately 6" in diameter by 15" deep is suspended in another vessel 2 ft. in diameter by 6" deep, and the latter is immersed in the reservoir where it is subjected to wind action. This vessel is fitted with a hook gauge, and every 24 hours an operator measures the quantity of water required to replace that which has evaporated. A similar gauge is buried in the earth on shore, and is protected from rainfall by a large glass frame. "Record of the reservoir gauge during rainfall is vitiated to a certain extent, and at times, due to meddlesome parties, the record on the land gauge is destroyed," says Manager J. E. Gibson, in his annual report.

During the 40 years that records of these gauges have been kept, evaporation from the water surface has averaged 47.06" per annum, and from the land surface 80.16". The averages by months for reservoir evaporation for the 40 years vary from a maximum of 5.47" for May to a minimum of 2.15" for December.

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Repairing a Cracked Water Main and Other Devices

About 15 years ago in Wilmington, N. C., a heavy storm blew down a bank of transformers hanging on a set of poles, and in falling they hit a 24" cast-iron main which was supported on a pile trestle over a swamp, and caused a longitudinal split in it about 4 ft. long at the spigot end, which leaked considerably. Since this main carried the entire supply for the city, it was decided to make temporary repairs rather than cut out the broken piece and insert a nipple and sleeve, which would have consumed all of one or two days. Instead a "temporary" repair was made, which still is in place. This was described by McKean Maffitt, superintendent of the water department, before the North Carolina Water & Sewage Works Ass'n, as follows:

Four two-piece clamps made of 1" x 1¼" flat steel with 1¼" bolts and nuts were on hand. These two-piece bands, or clamps, were used. They were placed around the pipe in such a manner that the crack in the main was between the two lugs where the pieces came nearly together. After placement, the bolts were gradually tightened, pulling the clamps tighter and tighter around the pipe, tending to pull the ends of the clamps that were over the crack closer and closer together. Beginning at the end of the crack away from the bell joint, the clamps were tightened successively towards the bell, all the time using light hammers with which to vibrate the pipe so that the rough edges of the inside of the crack would have an opportunity to be properly fitted together. After the clamps had been gone over three or four times, tightening each succeeding bolt slightly at each go-over, the leakage had been reduced to a mere drip. Then the lead joint at the spigot end of the cracked piece of pipe was caulked and the job left as being, at least temporarily, complete. That was about 15 years ago and the bolts are still good, the clamps in fair condition and the leakage not apparent."

Mr. Maffitt described a number of other interesting experiences. Several of them were connected with the forcing of service pipes across a street without excavating, this being done by forcing water through the service, with occasional driving. The soil being loose sand, the water returned back along the pipe and the latter was pushed through easily. But occasionally the pipe hit some other object, such as a telephone cable or power conduit, and sometimes there was trouble. In one case, 22 telephones were put out of commission; in one instance when a power line was hit, the current from the conduit fused a connection between it and the service.

A wrinkle used by his department when a lead gooseneck breaks off and floods the trench with water is to use a length of 2" pipe bent to an angle near one end and insert this end over the broken and discharging end of the gooseneck. This not only discharges the water outside the excavation, but also sucks into the annular space between the 2" pipe and the gooseneck such water as may be in excavation and removes this also, eliminating the necessity for using a trench pump.

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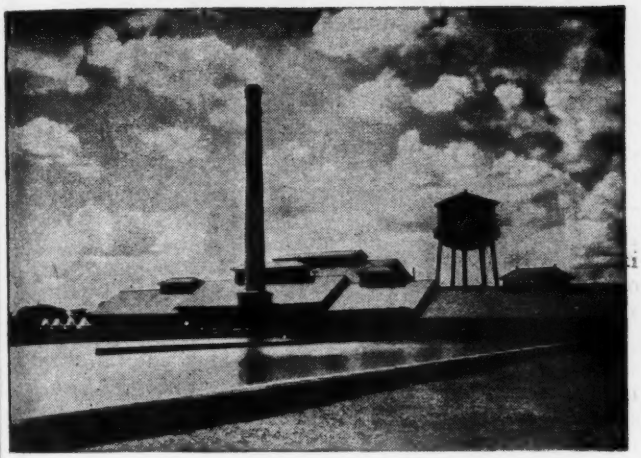

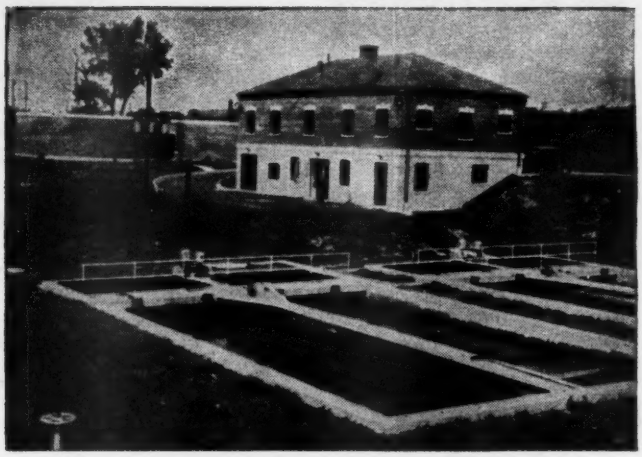

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(Continued from page 17)

was not made necessary by conditions existing at the time.

The Iron Mountain and the Eagle Mountain reservoirs (both located on the Colorado River aqueduct system about 170-180 miles east of Los Angeles) were constructed in 1937 and 1938, and lined with the natural soil mixed in place with SC-2 and then sealed with 150-200 penetration asphalt and stone chips, giving a lining 6" thick. The Iron Mountain dam required no aggregate material other than that found on the site, but at Eagle Mountain 10 to 15 per cent of imported fine aggregate was added to bring the mechanical analysis to the following:

Sieve Size	Percent Passing
¾ in. round screen	90
No. 4	70
No. 10	58
No. 50	28
No. 200	4

Enough aggregate was windrowed on the reservoir floor to construct a compacted layer 6" thick over the entire area to be lined (51,498 sq. yd.). SC-2 was mixed with this material at the rate of 4 to 4½ gallons per square yard of surface. This material was then mixed, spread and compacted by rolling. A seal coat of 150-200 penetration asphalt was then applied in two coats to the amount of ⅝ gallon per square yard. Following this, 30 pounds per square yard of ⅜ inch granite chips were uniformly distributed over the surface, broomed and rolled lightly. No structure trouble has been experienced with either of these reservoirs. Some of the granite chips have been dislodged by wave action and deposited at the various water levels, which indicates the desirability of using a finer cover aggregate, such as sand.

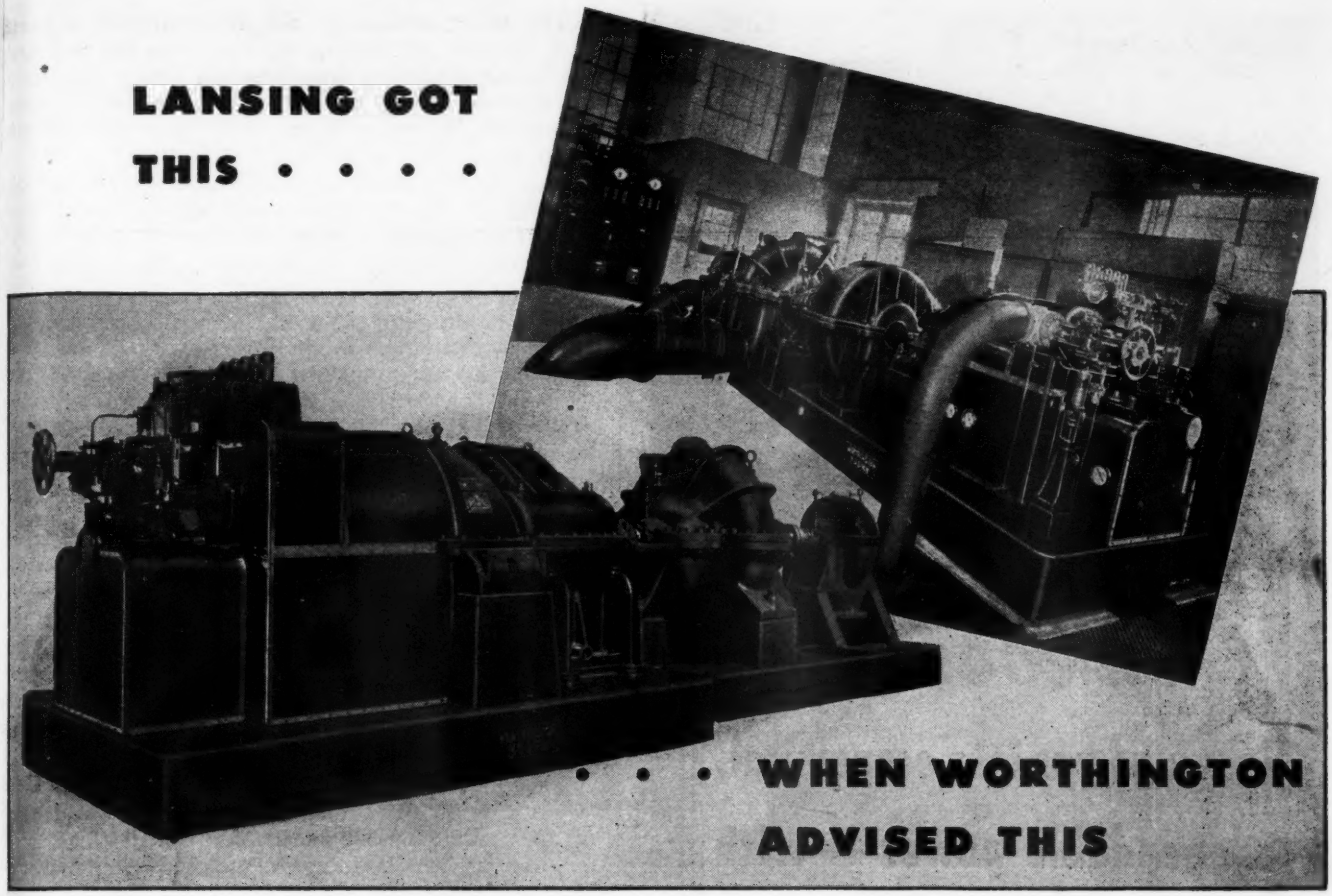
Hot Mix Asphaltic Concrete

At approximately the same time that work was initiated using mixed-in-place asphaltic linings, work employing hot-mix asphaltic concrete was started. In 1924 the Oroville reservoir near Oroville, California, was lined with a hot-mixed, hot-laid asphaltic concrete 1½ inches thick, being practically a sheet-asphalt paving mix using 50-60 penetration asphaltic cement. As might have been expected, the lining is now brittle and severely cracked above the water line. However, there has been no seepage noticed. To prevent the growth of weeds, ½ gallon of a 2% solution of Cresol per square yard was applied to the soil before laying the lining. Notwithstanding this precaution, there has been considerable growth above the water level, which has been explained as being due to seeds falling into soil embedded in surface cracks. In the near future it is planned to seal these cracks.

Near Los Angeles, Calif., is located the Sante-Fe Springs reservoir, constructed in 1928 and lined with a hot-mix, hot-laid sand-asphalt 1½ to 2 inches thick, with the following constitution:

Material	Percent Passing
Clean fine sand	76
#200 (limestone dust)	10
Asphalt (about 50 penetration)	14

The mixture was compacted with a hand roller.



The Result: Tops in Operating Efficiency and Economy

In 1941, the City of Lansing, Michigan installed this Worthington 20″ x 24″ — LC-3 volute centrifugal pump driven by a Worthington 5000 rpm Steam Turbine. The pump is rated at 10 to 20 MGD against 150 to 200 ft. head. After four years of service, it still rates tops with the City of Lansing, on the basis of operating efficiency and economy.

It's not surprising that it should. Laboratory tests, initiated by Worthington in 1918 on actual pump models, are backed by installation and field testing under supervision of a trained Worthington field engineer — a sure guarantee of efficient performance. You know you're on safe ground when Worthington *wins* the bid.

ADVANTAGES OF WORTHINGTON'S COMPLETE LINE

Another reason why more jobs go to Worthington is demonstrated in the Lansing installation . . . *completeness of line*. All of the elements making up this Worthington steam turbine driven, condensing, centrifugal waterworks pumping unit are manufactured by Worthington . . . pump, geared turbine, condenser and auxiliaries providing *undivided responsibility*. That one reason is why Worthington is first choice for so many municipal waterworks.

For specific information on Worthington LC-3 Centrifugal Pumps as installed in the City of Lansing, write for Bulletin W-312-B9A. It proves that *there's more worth in Worthington. Worthington Pump and Machinery Corporation, Harrison, N. J.*

MORE JOBS GO TO WORTHINGTON

The complete line . . . the top engineering

Centrifugal Pumps
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Vertical Turbine Pumps
Water Meters
Power Transmission Equipment
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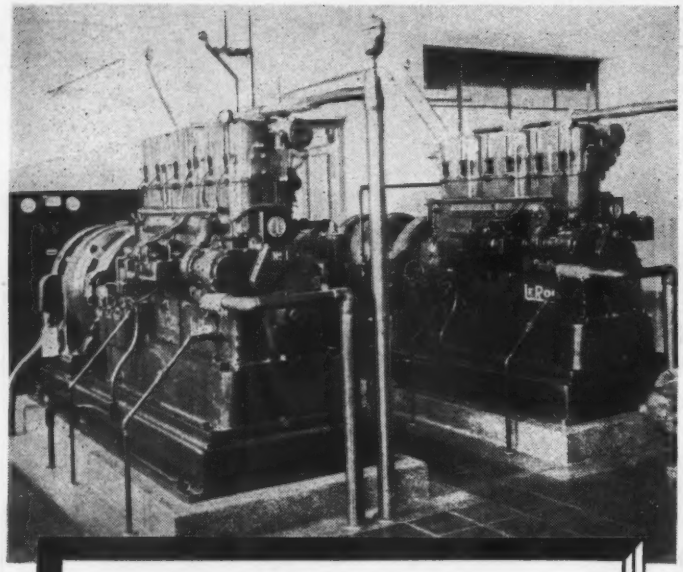
WORTHINGTON

24W5-5

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*



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In the Oshkosh, Wisconsin Municipal Sewage Disposal Plant, two model RX1S Le Roi Engines — operating on "no-cost" sewage gas — have established a long-time record of efficient, dependable operation.

If sewage gas is available at your plant, simply send us the B.t.u. content and the cu. ft. available per hour, and our engineers will work out a practical, money-saving program. The necessary compression and carburetion are readily arranged.

Built to quality standards

You can depend on Le Roi Engines for outstanding performance, because they are built by a manufacturer *concentrating exclusively* on the problems of the heavy-duty field. These units have the engineered design, precision-machined parts, and quality features that back up your good judgment in selecting them. You are assured of giving your municipality dependable, low-cost power.

Le Roi Engines are available in sizes from 4 to 400 H.P. utilizing sewage gas, natural gas, gasoline, or butane.

Write for complete information.

E-52

Le Roi Company
1770 S. 68th Street Milwaukee 14, Wisconsin

LE ROI MILWAUKEE

ENGINES • ENGINE-GENERATORS
PORTABLE AIR COMPRESSORS

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The water surface of this reservoir has a great deal of crude oil floating in it and this has softened the lining somewhat. Otherwise the lining has given satisfaction. Through a few cracks near the top, some vegetation is beginning to show, but this growth could be removed at but slight expense.

The San Fernando reservoir, near the city of the same name, was constructed in 1941 and lined with hot-mixed, hot-laid asphaltic concrete 3" to 4" thick, composed of 200-300 penetration asphalt mixed with a one inch maximum sized aggregate (the mechanical analysis complying with the regular Los Angeles street paving). The mixture was dumped down the reservoir slopes, spread by hand-labor, smoothed by strike-off boards riding on headers carefully set to grade, and then rolled by a single drum roller towed by a tractor-mounted winch at the top of the slope. The layer's thickness varied from three to four inches, depending upon the expected severity of erosion. No maintenance has been required, beyond the repair of three short sections where bank slip-outs occurred. Wave action along the constant-level water line is slowly eroding the asphalt-sand matrix, exposing the coarse aggregate. This condition is not serious, but does show the advantage of employing an aggregate of smaller maximum size and incorporating as much asphalt as is possible while still retaining adequate stability.

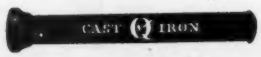
The Rowena reservoir (Los Angeles) was constructed in 1942 and lined with hot-mix, hot-laid type 4" thick, using 200-300 penetration asphalt mixed with one-inch maximum size aggregate complying with the standard gradation specifications for Los Angeles street pavements. The roller was handled in a manner similar to that described above. This lining is in excellent condition except for cracks that have appeared along two of the sides, where the underlying embankment settled because it was not properly compacted. No maintenance work has been applied.

Elysian Park reservoir, Los Angeles, was constructed in 1943 and lined with a hot-mixed, hot-laid asphaltic concrete three inches thick, composed of one inch maximum size aggregate and a 50-60 penetration asphalt. The above mixture was spread and smoothed off in much the same manner as that employed on the San Fernando reservoir, and was then compacted first with a hot roller weighing 400 pounds per foot of width, and then cold rolled with a roller weighing 2000 pounds, towed in the same manner as was described just above. An innovation on this reservoir was the application of a sprayed surface coating, consisting of a thin spray of neat Portland cement mixed with 7.0 gallons of water per sack and 8% by weight of calcium chloride. This coating was applied at the rate of about 65 square yards per sack of cement. Its purpose was to protect the asphaltic concrete from the surface tension of drying clay or algae. In this reservoir an especial attempt was made to thoroughly compact the subgrade upon which the asphaltic concrete rested. Both sides and bottom were given a 3-foot layer of selected, sandy clay, well compacted. This layer extended somewhat above the finished grade, was trimmed with a tractor-drawn scraper, and then hand finished to exact grade. This precaution afforded a hard, smooth and dense floor for the asphaltic concrete blanket.

The De Soto Street reservoir, at Chatsworth, Calif, was constructed in 1941. The lining is a 4" thick blan-

Not for a decade, not for a generation, but for a *century* or more, cast iron pipe serves faithfully and economically in water, gas and sewerage systems. Its known useful life is more than double the estimated life of other pipe used for underground mains. Replacements sooner or later required when shorter-lived pipe is installed are avoided by the use of cast iron pipe, thus saving many millions of tax dollars. That is why cast iron pipe is so often referred to as Public Tax Saver No. 1.

Cast Iron Pipe Research Association, Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3, Illinois.



CAST IRON PIPE

SERVES FOR CENTURIES

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ket composed of 200-300 penetration asphalt mixed with one inch maximum size aggregate which complies with the standard specifications for street paving in Los Angeles. The mixture was handled and smoothed as in the foregoing examples, and then compacted with a single-drum roller drawn by a mechanism similar to that used in the examples cited above. On the asphaltic concrete blanket was placed a heavy coating of cement grout, but without the curing agent used in the Elysian Park reservoir. Because of this lack of a curing agent, together with the heaviness of the coating, temperature and moisture expansion is causing V-shaped ridges to form—although no damage to the underlying blanket has resulted.

Use Of Reinforcing In Blanket

A part of the Los Angeles County Flood Control District is the Hay Canyon Debris Basin Dike near Pasadena, Calif., whose lining was constructed in 1936. This lining is a 3″ blanket of dense graded asphaltic concrete reinforced with a layer of wire mesh fencing of the Elwood Type "F" design. This wire reinforcing was tied to pipes five feet long, driven at five foot centers into the bank and was intended to give added strength and stability to the blanket to enable it to resist the destructive effect of the turbulent sand and gravel-ladened water discharged from the canyon above. Recent surveys indicate, however, the uselessness—in fact, the detrimental effect—of such reinforcement. Aggregates for the asphaltic concrete, which was compacted with a 350 pound hand roller, winch-operated from the top of the bank, met the following requirements.

Screen Size	Percent passing
¼ inch	100
#10	30-55
#40	20-30
#200	6-10

To the above aggregate was added 8.8 percent of 50-60 penetration asphalt. This mixture was handspread on the dike face, and the wire-mesh reinforcement was raised to the approximate center of the layer. No damage or wear to this blanket have been noticed, although the protection has been subjected to several severe floods; nor does any weed growth appear through the lining.

Also near Los Angeles is the Stough Canyon Debris Basin Dam and Run-off Channel, whose lining was constructed in 1940. Both the upstream face of the dam and the floor and sides of the Channel were paved with 3″ of a mix having the same constitution as was used for the Hay Canyon dike. All asphaltic concrete linings were reinforced in a similar manner, but after the wire mesh had been laid and tied to the anchor pipes, the sub-grade was sprayed to prevent weed growth, with one quarter gallon per square yard of a mixture of 50 percent creosote and 50 percent kerosene extract.

The only maintenance required by this construction has been the removal of heavy roots left in the face of the excavated areas during construction. These roots sprouted later, and had to be removed. No weed growth has been noticed.

As to cost, nothing very definite can be said. During the twenty-odd years during which these reservoirs

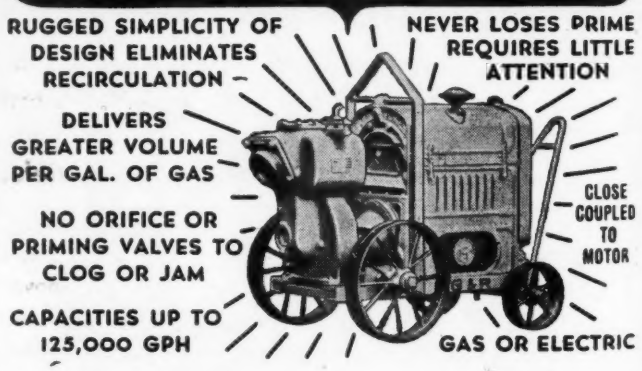
CUT MAINTENANCE COSTS 75%

Concrete slab maintenance costs can be reduced as much as 75% by the Koehring Mud-Jack Method. The Mud-Jack raises sunken concrete walks, curbs and gutters, driveways, streets, and airport runways eliminating reconstruction costs. Write for the new Mud-Jack Bulletin which is both illustrative and descriptive.

KOEHRING COMPANY
Milwaukee, Wisconsin

MUD-JACK METHOD

Streamlined Inside
for Higher Efficiency and Lower Operating Costs


RUGGED SIMPLICITY OF DESIGN ELIMINATES RECIRCULATION
NEVER LOSES PRIME REQUIRES LITTLE ATTENTION
DELIVERS GREATER VOLUME PER GAL. OF GAS
CLOSE COUPLED TO MOTOR
NO ORIFICE OR PRIMING VALVES TO CLOG OR JAM
CAPACITIES UP TO 125,000 GPH
GAS OR ELECTRIC

Streamlined where it counts, you can't clog a Gorman-Rupp Self-Priming Pump. Unequaled in rugged efficiency, gallonage or continuous hours. A size and type for every need.

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THE **General**

TYPE 10 - MODEL 105

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THE ORIGINAL

"MACHINE OF TOMORROW"

ONE MAN
ONE ENGINE
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General Ironguts is proud to commission this newest General for duty on the construction, excavating and materials handling "fronts." Built by General—the company that pioneered the one-man, one-engine, rubber-tired Supercrane five years ago—this latest General is another "first" that takes its place as a leader in the construction machinery field.

ALL-IN-ONE. The General Type 10, Model 105 is a combination unit that will turn in profits on any job. Shovel, crane, backhoe, dragline, magnet or pile driver . . . you name the job, then watch this amazing machine do the work faster, better and cheaper!

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AND ALL THIS. Fast highway travel (more than 20 mph) with absolute safety, air booster steering, optional four-wheel drive, heavy duty clutches and transmission, 4 speeds forward, 4 speeds reverse, easy, quick changeover of attachments . . . mobility and ease of operation that get the most difficult jobs done in record time! Conforms to all highway regulations and in most states needs no permit to travel over the roads.

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CRANES-SHOVELS MARION OHIO U.S.A. GENERAL OSGOOD

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CRANES, DRAGLINES AND SHOVELS

have been built prices have changed greatly; costs of the lining have not always been kept separate from others; and what items are included in such costs may vary. The following costs are given as reported, for what they may be worth. They are supposed to cover lining alone, not embankment or foundation.

Mixed-in-place: Arlington, 56 cents per sq. yd. Eagle Mountain, area 47,848 sq. yd., 36.6 cents. Iron Mountain, 51,498 sq. yd., 41.7 cents.

Hot-mixed: Oroville, 1,350 sq. yd., 93.3 cents. Hay Canyon, 750 sq. yd., reinforced, 99 cents.

Repair of Flood-Damaged California Bridges

(Continued from page 23)

the concrete deck as much as two feet, while some of the bent columns dropped away from the girders as much as five feet.

Two of the settled bents were not damaged to any extent and were re-used. The deck was merely jacked back to grade and supported on concrete "shims" cast in place to the proper height. The more severely damaged bents, shown in Fig. 3, were brought to proper grade by cutting the cap and separating two of the columns from the others. These two columns were properly aligned and extended by adding a new cap to bring them to correct grade. The completed job is shown by Fig. 5.

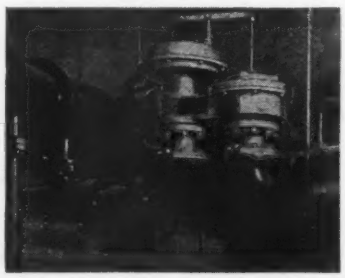
Fig. 6 is a photo taken, before the flood of March, 1938, of the bridge across the South Branch of Big Tajunga Wash, on the Foothill Boulevard, City of Los Angeles, California. Fig. 7 illustrates the destructive effects of the flood, which washed out the supporting shale under the pier at the north end, which settled about 0.8 ft. at one side of the structure, and about 0.4 ft. at the other side. In correcting the settlement, holes were cut under each of the girders and eight 50- to 100-ton mechanical jacks were inserted in these holes to take over the dead load of the deck. The concrete and its vertical steel reinforcing rods were then cut away as is shown on Fig. 7, allowing the deck to be jacked to grade. Steel dowels lapping the exposed vertical steel reinforcing were placed, and the removed concrete was replaced by concrete made with high-early-strength cement. To prevent future damage to the pier, a protective mat of sacked concrete was placed about the pier footing as shown in Fig. 7.

DDT Kills Filter Flies

Experimental work at Atlanta, Ga., by Capt. John A. Carollo of the Fourth Service Command Laboratory, working under the general direction of the Sanitary Engineering Division, Surgeon General's Office, demonstrated that 1 ppm of DDT, applied as an emulsion in the sewage applied to trickling filters, kills all psychoda. The treatment is applied for 24 hours once a week. It is extremely effective in preventing development of filter flies and does not affect the filter from the standpoint of biological results.

At Alexandria, Virginia, a dose of 0.01 ppm of DDT eliminated midge fly larvae from storage reservoirs when copper sulphate had proved to be ineffective.

P.F.T. Flame Traps Protect the Sewage Treatment Plants of Over 235 War Projects



In camps and armament plants throughout the nation, the fire and explosion hazards created by sewage gas at the disposal plants are eliminated by P.F.T. Flame Traps. P.F.T. Boiler Room Equipment is preferred.

Write for Bulletin No. 121-A describing P.F.T. Flame Traps, Pressure Relief Valves, Waste Gas Burners, Condensate Drip Traps, Pressure Gages and other boiler room accessories which assure safe operation of digested sewage sludge treatment plants.

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4241 Ravenswood Ave., Chicago, Ill.
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NATCO UNIFILTER TILE FOR TRICKLING FILTER SYSTEMS

One piece underdrain

Egg-shaped run-off

Rapid, complete ventilation

Salt glazed surfaces

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NATIONAL FIREPROOFING CORP.
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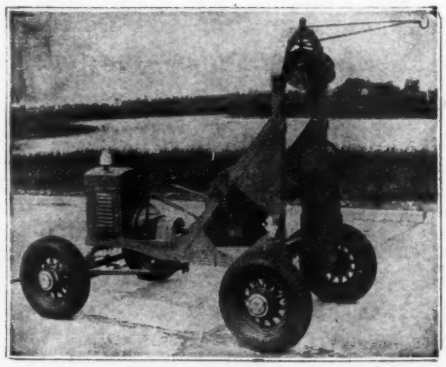
KEEP THOSE SEWERS OPEN!



Sewers clogged with sand, roots and other debris are a constant danger to public health and safety. New installations rapidly lose their efficiency due to sand seepage.

You positively can keep the sewers of your city open with an OK Champion—the cleaner that does the entire job from street level. Dig-ups practically a thing of the past.

Three Distinctive Models Available. Write Now for Literature.

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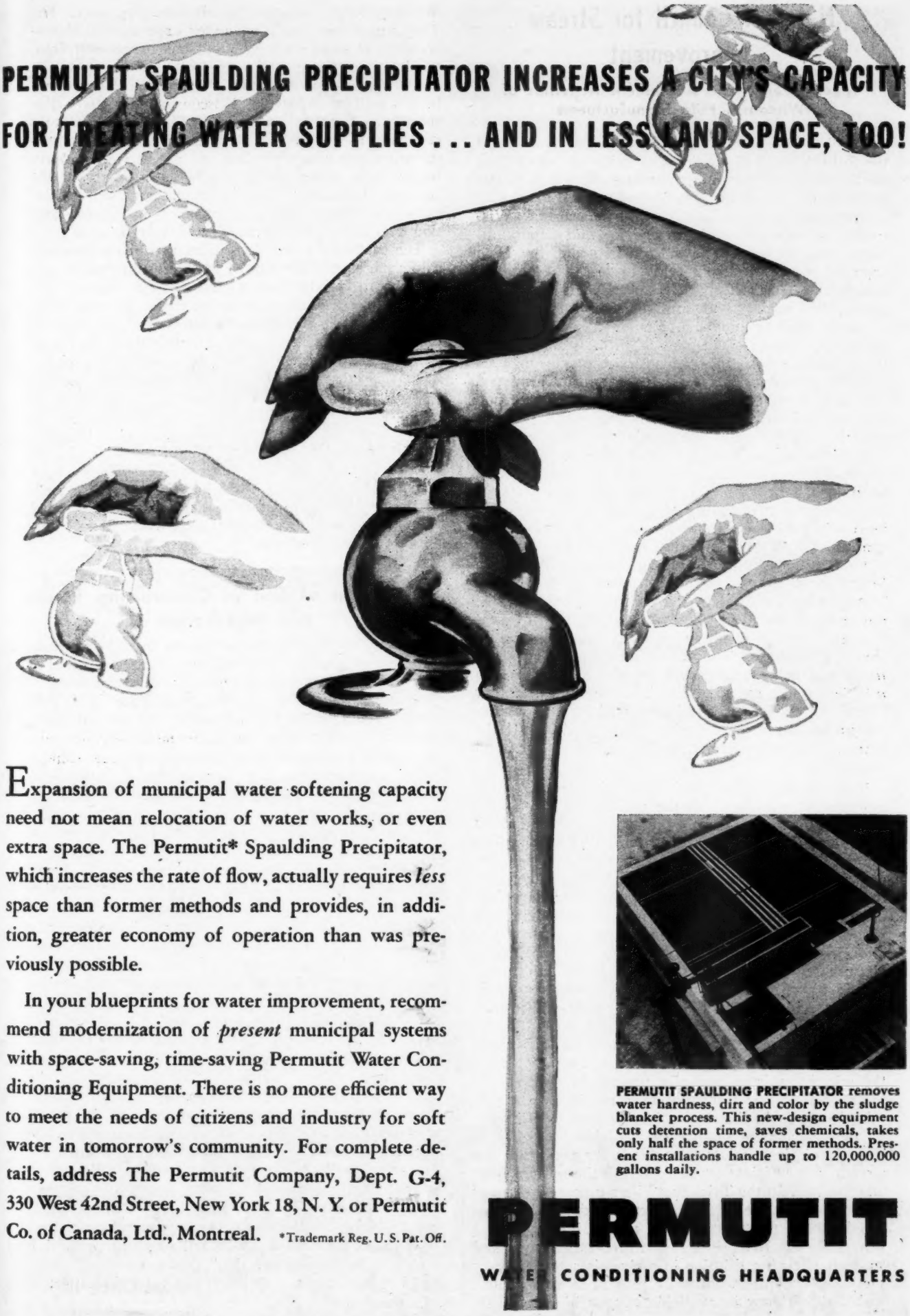
PERMUTIT SPAULDING PRECIPITATOR INCREASES A CITY'S CAPACITY FOR TREATING WATER SUPPLIES . . . AND IN LESS LAND SPACE, TOO!



Expansion of municipal water softening capacity need not mean relocation of water works, or even extra space. The Permutit* Spaulding Precipitator, which increases the rate of flow, actually requires *less* space than former methods and provides, in addition, greater economy of operation than was previously possible.

In your blueprints for water improvement, recommend modernization of *present* municipal systems with space-saving, time-saving Permutit Water Conditioning Equipment. There is no more efficient way to meet the needs of citizens and industry for soft water in tomorrow's community. For complete details, address The Permutit Company, Dept. G-4, 330 West 42nd Street, New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal. *Trademark Reg. U. S. Pat. Off.

PERMUTIT SPAULDING PRECIPITATOR removes water hardness, dirt and color by the sludge blanket process. This new-design equipment cuts detention time, saves chemicals, takes only half the space of former methods. Present installations handle up to 120,000,000 gallons daily.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

National Council for Stream Improvement

Takes Over Waste Abatement Activities of Wisconsin Pulp Manufacturers

The National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries) Inc., and the Sulphite Pulp Manufacturers' Committee on Waste Disposal of Wisconsin have completed an agreement whereby the national group will take over the Wisconsin group's activities in the pulp and paper mill waste disposal field. The Wisconsin group has been engaged for the past six years in research activities centered at The Institute of Paper Chemistry at Appleton, Wisconsin, to determine means of disposing of waste sulphite liquors in a manner consistent with the public interest. Concurrently with its activities in the abatement field, the Wisconsin group, through its research group at The Institute of Paper Chemistry, has carried on scientific investigation in connection with the utilization of chemicals and other valuable materials which, under current day practice, are generally discharged with the waste liquor. The work sponsored by the Wisconsin group has been carried on under the direction of J. M. Holderby, Coordinator, and more recently, during Mr. Holderby's absence in service in the Armed Forces, under A. J. Wiley. Cooperating in these activities were L. F. Warrick, State Sanitary Engineer of the State of Wisconsin Board of Health, and other personnel of the Board. These latter activities in the utilization field will be continued by the Wisconsin group at the present location and with present personnel at The Institute of Paper Chemistry. The waste abatement activities which are being taken over by the national group will likewise be carried on at The Institute of Paper Chemistry by the personnel employed by the Wisconsin group but will be under the supervision of the National Council for Stream Improvement, Inc., and financed by it.

The waste disposal problem of sulphite pulp mills is common to mills in all the various regions of the United States where such operations are carried on and the national aspects of the problem have influenced the decision of the Wisconsin group to relinquish this phase of its activities to the National Council for Stream Improvement, Inc. Other pulp and paper industry groups are currently investigating the disposal of waste sulphite liquors along somewhat parallel lines. Through the agency of the National Council such activities will be coordinated and duplication of effort and needless expenditures avoided.

The specific projects taken over from the Wisconsin group include the Trickling Filter and River Reaeration Projects. Waste sulphite liquors contain materials (mainly wood sugars) which are fermented by the microorganisms normally present in streams. In the process of this fermentation, a portion of the dissolved oxygen in the stream is consumed, thereby reducing the amount of oxygen available for fish life. The two projects relate to methods for providing the stream with sufficient oxygen for both the fermentation and fish life. In the Trickling Filter process the liquor is treated and the biological oxygen demand is satisfied before the waste liquor passes into receiving waters. In the River Reaeration process the untreated waste liquor after dilution in a river is acted upon by the micro-organisms naturally present in river water, and the deficiency in available oxygen is satisfied by diffusing large amounts of air into the river. The Trickling Filter has been under experimental development for some six years, and has progressed from the laboratory stage to a 15-foot filter in operation at the Consolidated Water Power and Paper Company's mill at Appleton, Wisconsin. The River Reaeration is in actual operation at the Flambeau Paper Company at Park Falls, Wisconsin. All of the physical properties, research data, and patent rights applying to these two projects became the property of the National Council by the agreement, and will be developed in the interest of its members in full cooperation with the regulatory agencies involved.

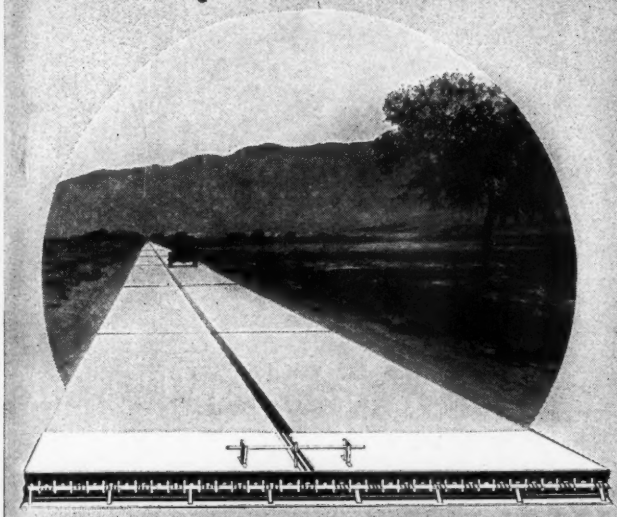
The National Council includes within its membership some eighty per cent of the total pulp, paper and paperboard production of the United States, and through the use of cooperative funds is attempting to arrive at a solution to the industries' problems in the waste abatement and utilization fields. Fellowships have been established at the Mellon Institute of Industrial Research in Pittsburgh, Manhattan College in New York, The Institute of Paper Chemistry at Appleton, Wisconsin, the University of Michigan at Ann Arbor, Purdue University at Lafayette, Indiana, and Rutgers University at New Brunswick, N. J. The projects at these institutions are established on an individual basis, each one having to do with some particular industry problem, and are coordinated through the National Council to provide a well balanced research program.

Compaction of Soil in Constructing Roads and Aerodromes

Field tests on soil compaction as used in the construction of roads and aerodromes, were conducted at the Road Research Laboratory at Harmondsworth, England. From these tests and from the work of previous investigators the following conclusions were reached: (1) Extra rolling is beneficial only on soils of relatively dry consistence rolled at moisture content below the optimum. (2) Increase in the compacted density increases the strength and stability, and reduces the capacity to absorb water. (3) It is desirable to compact soil in thin layers, since compaction equipment is generally less effective as the depth of soil increases. (4) Provided that the soil is strong enough to support it, the heavier the compaction equipment, the more effective is the compaction, and the greater is the depth of soil that can be successfully compacted. (5) Rammers are effective on both non-cohesive and cohesive soils; rollers are effective on soils possessing cohesion, but not on loose cohesionless soils; and vibrators are very effective on non-cohesive soils, particularly loose sands, but not on cohesive soils. (6) In tests on a silty clay of 6-in. compacted thickness, five passes of a smooth 8-ton, or a pneumatic-tired roller, were sufficient to produce the greater part of the compaction possible with this equipment. With a sheepfoot roller more than 10 passes were required to produce the corresponding effect, the greatest number of passes being necessary when the feet were small. The best of the sheepfoot rollers tried produced higher densities than could be obtained with the other types of roller used. (7) Comparison of the soil densities measured *in situ* with those obtained in the laboratory after a standard amount of ramming yields a "relative compaction" that can be used as the basis of performance specifications for the compaction of earthworks.

There's no Disagreement on .....

Road Joints!



AFTER 10 YEARS—A ROAD WITH KEYLODE JOINTS LOOKS LIKE THIS

In the 20s and 30s when concrete road building was getting its start, it was logical for highway engineers to resist the use of metal road joints. These joints were costly and new. Their use would cut down the total miles of hard road that could be built with the money at hand—and farmers were stuck in the mud!

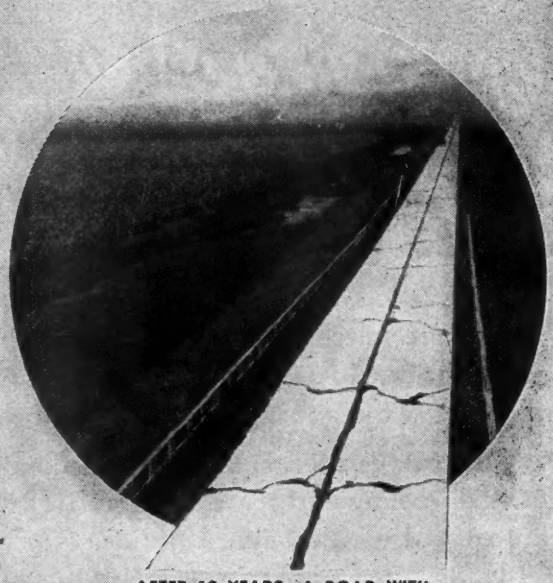
The objective *then* was *miles today*. The cost tomorrow in maintenance was a secondary consideration.

In 1934 Federal engineers, realizing the necessity for *crack control* in concrete pavements, issued a bulletin requiring expansion and contraction joints on all new federal-aid highways. The large reduction in maintenance costs on federal-aid roads attests the wisdom of this action.

Today there's no disagreement on road joints. Everyone agrees that crack control in concrete pavements by the use of load transferring expansion and contraction joints is an economic necessity. The only unsettled problems involve the spacing, the design and the cost.

The mass of available data will make it easy for highway engineers to establish a joint spacing standard soon.

Many engineers have already decided that the KEYLODE contraction joint is the design they want—and the cost of KEYLODE joints is so little that you can get BOTH *miles today* and *crack control tomorrow* for the same money.



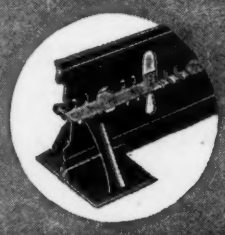
AFTER 10 YEARS—A ROAD WITHOUT JOINTS LOOKS LIKE THIS

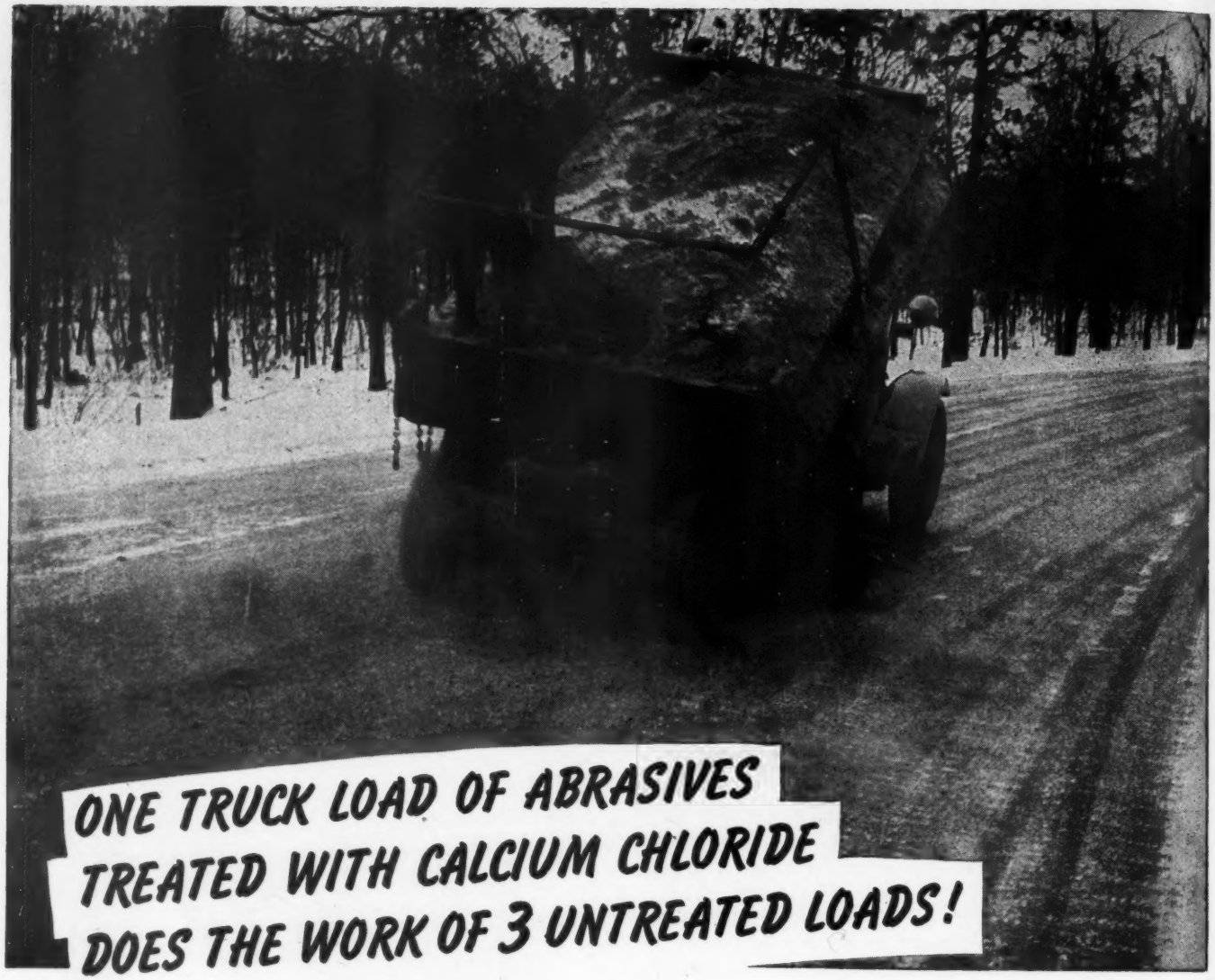
HIGHWAY STEEL PRODUCTS CO.

Chicago Heights, Ill.

KEYLODE

CONTRACTION JOINTS





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Potomac River Basin Commission Issues an Introductory Report

During the first week of August, 1945, the governor of Pennsylvania by his signature made unanimous the acceptance of the terms of the compact under which the Interstate Commission on the Potomac River Basin is to operate. The compact was approved by the Senate and the House of Representatives of the United States of America in congress assembled July 11, 1940, and was accepted by the governmental bodies concerned on the various dates here given: Virginia, 1940; Maryland, 1941; District of Columbia, 1941; and West Virginia, 1941.

Under the compact, the duties of the commission are:

1. To coordinate, tabulate, and summarize existing data on the pollution, character and condition of the streams of the Potomac River basin.
2. To supplement existing data, if necessary, by conducting investigations.
3. To promote adoption by the signatory bodies of uniform legislation for the control of stream pollution.
4. To disseminate information to the public on the effects of stream pollution and the objectives of the Commission.
5. To cooperate with other organizations in, and conduct, if advisable, studies of treatment methods for sewage and industrial wastes.
6. To recommend to the signatory bodies standards for cleanliness of streams.

The parties signatory to the compact mutually agree to:

1. Faithful cooperation in the abatement and control of pollution in the streams of the Basin.
2. The enactment of adequate and, in so far as practical, uniform legislation for the abatement and control of such pollution.
3. The appropriation of funds to finance the operations of a coordinating agency.

As its first technical accomplishment, the commission has tentatively adopted criteria for four classes of water, permitting the basin to be considered from as many points of view for appropriate treatment of stream pollution problems.

Class A. The waters of a stream needing no treatment beyond chlorination to make it potable.

Class B. The waters of a stream requiring no treatment to make it suitable for bathing, fish life and recreation.

Class C. Water suitable for domestic use only after complete treatment.

Class D. Stream flow of poor quality, yet sufficiently pure not to make it a public nuisance.

The commission has released a 61-p. well-illustrated brochure entitled "The Potomac River Basin." Intended as an introductory report, this descriptive publication tells much that is of interest not only to the residents of the basin, but to engineers who are certain to find considerable data that should prove of value to them.

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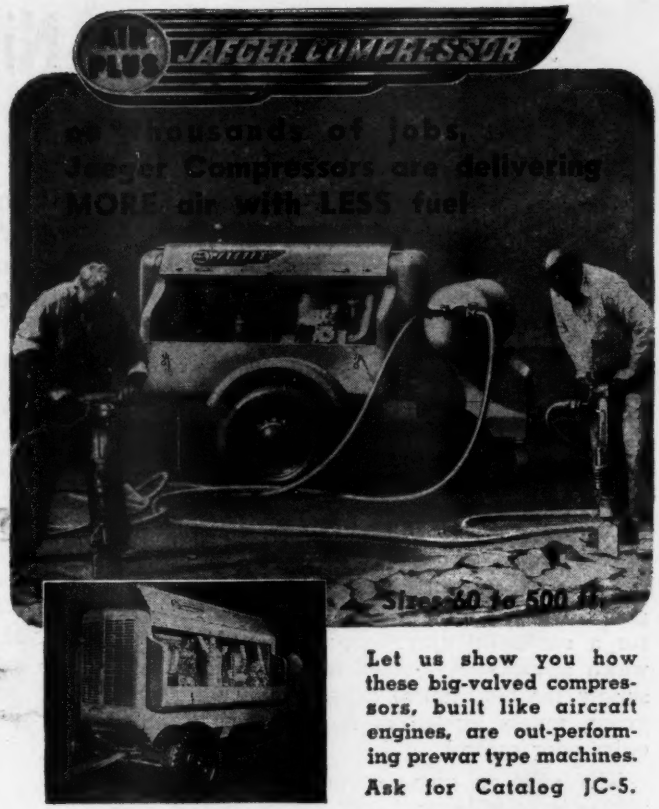

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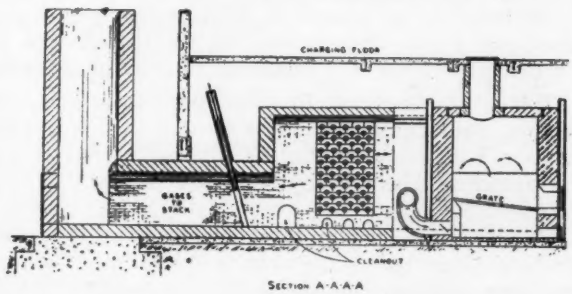

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Use of Sodium Nitrate in Treating Cannery Wastes

Discussion of experiences in disposing of cannery wastes in lagoons, including sodium nitrate treatment of such wastes to furnish oxygen, stimulate growth of chlorophyllaceous organisms, and maintain an alkaline reaction.

THE Research Laboratory of the National Canners Association has recently published a bulletin (No. 29 L) which discusses experiences in disposing of cannery wastes by discharge into lagoons, as reported by L. F. Warrick and T. T. Wisniewski of the Wisconsin State Board of Health and N. H. Sanborn of the National Canners Association. The following is an abstract of this report.

Lagoons are of two general types—absorption lagoons, which depend largely on rapid soil absorption for a successful operation, and holding lagoons, in which advantage is taken of atmospheric oxygen to supply the biochemical oxygen demand. Holding lagoons, unless located in remote areas, definitely require odor control.

The average quantity and strength of cannery wastes is as follows:

Type of Waste	*Gallons per Case*	*p.p.m.*	*lbs. per Case*
Beans, Green or Wax	26	200	0.043
Beans, Lima	50	450	.156
Beets	25	2,500	.52
Corn	25	3,000	.63
Peas	25	2,400	.50

Studies on the sodium nitrate treatment of lagooned cannery wastes were based on original research by N. H. Sanborn of the National Canners Assn. The addition of sodium nitrate eliminates or reduces odors, depending on the amount of chemicals added. The function of the sodium nitrate is considered to be three-fold: a. to furnish oxygen for aerobic bacterial decomposition during the early stages of the process; b. to stimulate the growth of chlorophyllaceous organisms, which in turn produce additional oxygen by photosynthesis; and c. to maintain an alkaline reaction.

During the process of decomposition of cannery wastes, an oxygen demand is created that is greatly in excess of that which can be supplied through natural aeration. The dissolved oxygen is first used up, followed by nitrate and nitrite oxygen and then sulphate oxygen. Each supply of oxygen is nearly or entirely used up before the next is drawn on. When the sulphates are decomposed, odors are created.

The function of the sodium nitrate is to supply a source of oxygen, thereby delaying the stage of sulphate decomposition. Economically it is not feasible to add enough sodium nitrate to satisfy completely the oxygen demand of the waste, but enough can be added to meet the major needs while atmospheric oxygen is becoming available. In effect, the oxygen sag curve is maintained above the critical point. It has been found that the addition of enough oxygen, as sodium nitrate, to satisfy approximately 20% of the 5-day B.O.D. will result in the production of only slight odors, not noticeable beyond about 200 feet from the lagoon.

Agricultural sodium nitrate contains 54.7% of oxygen by weight. At Hoopeston, Ill., 2.88 pounds dissolved in water was added to the 300 gallons of waste that was being produced per minute. The B.O.D. of these wastes was about 3,500 ppm, and the amount of sodium nitrate added was 18% of the 5-day B.O.D. Similar results were obtained at Lake Mills, South Beaver Dam, Medford, Poynette, Brandon, Theresa and Granville, Wisc.

The addition of silage juice, which is produced by fermentation of the vines or plants, may create odor, despite the addition of the sodium nitrate. Silage juice may have a pH as low as 3.6, a 5-day B.O.D. of 75,000 or more, and a total solids content of 70,000 or more. Other factors that may create odors are failure to add sodium nitrate during the first few days of operation, or failure to increase the dosage when a lower grade chemical, containing less oxygen, is used.

Lagoons containing sodium nitrate-treated wastes do not require as large a quantity of the chemical when a second waste is later introduced into the lagoon. It appears that the new incoming wastes are seeded with desirable types of organisms by the retained wastes.

The critical period in a nitrate treated lagoon is the first two or three weeks after operation has been started. It is during this period that waste retained from preceding operations, even from the year before, is most effective. It is recommended that lagoons be large enough to permit retention of waste in them, normally about 25%, from year to year. Where this is not possible, it is better to increase the dosage of sodium nitrate by about one-third during this critical period.

The biochemical oxygen demand of nitrate-treated lagooned wastes drops rapidly following the close of the packing season. At Medford, Wisc., where the raw waste B.O.D. varied from 1017 to 1820, a reduction of 86% occurred in the 30 days following the close of the pack, and in another 35 days the B.O.D. had dropped to 45 ppm. At the same plant in 1942, when sodium hydroxide was used, the reduction in B.O.D. in the 30 days following the end of the pack was only 48%.

Precautions to be observed in the operation and use of sodium nitrate-treated lagoons include: a. the wastes must be screened, and no solids should by-pass the screening unit; b. the required amount of sodium nitrate should be added every day to all the waste discharged into the lagoon; c. silage juice should not, under any circumstances, be allowed to enter the lagoon; d. weeds should be removed from the lagoon, including the sides of inner walls; and e. the waste should be held in the lagoon for the required length of time.

The sodium nitrate is applied to the waste after screening. A solution of 2 pounds of the chemical to a gallon of water is convenient, and a mechanical stirrer is helpful. This solution may be applied by any con-

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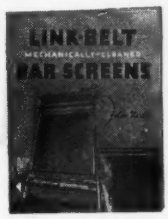

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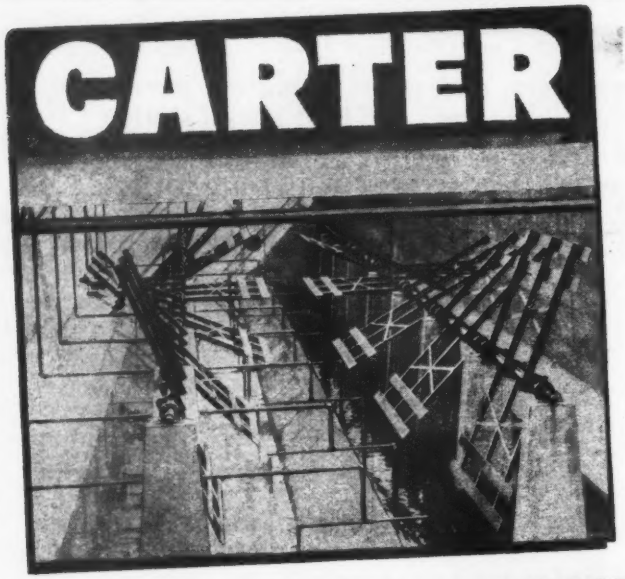
venient method capable of uniform feeding. It is also possible to add the required amount of chemical to the pump sump at frequent intervals.

A single large lagoon is preferable to several smaller ones. Two or more lagoons used in series is undesirable, as the first one receives strong fresh material without dilution by the partially treated waste. A depth of 3 feet is most desirable and 5 feet is the maximum recommended. The lagoon should be large enough to hold one-fourth more than the total seasonal volume of waste that is produced, so that a substantial amount of stabilized waste may be retained to dilute and seed the next year's waste. Seepage decreases yearly.

For each 1,000,000 gallons of waste, a lagoon area of 1.02 acres is required for a depth of 3 ft. The embankments around the lagoon should have a top width of 7 to 10 ft. The inner slopes should be 2½ horizontal to vertical and the outer slopes 2 to 1 A free-board of 2 to 3 ft. is desirable, after settlement has taken place. Rolled embankments of properly selected earth are very desirable, and both inner and outer slopes may require protection against burrowing animals. A drainage valve and pipe should be provided.

The use of sodium nitrate in this manner may possess advantages in the treatment of other highly putrescible industrial wastes. During the war, special wastes were produced at some plants which began to decompose within an hour, so that it was impossible to pass them through a settling tank and into a filter before anaerobic decomposition was under way. It is possible that a relatively small amount of sodium nitrate would have permitted the treatment of these wastes successfully in a standard treatment plant.



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Investigation of Dense Tar Road Surfaces

In the course of an investigation made primarily to enable a tar surfacing material to be evolved that would withstand fast-moving and turning tanks in addition to heavy traffic, dense tar surfacings of the stone-filled rolled asphalt type were laid experimentally in Surrey. The practical work was carried out concurrently with investigations undertaken by A. R. Lee and P. J. Rigden at the Road Research Laboratory, Harmondsworth, to develop satisfactory principles of design for such surfacings. Surfacings conforming to three different specifications were prepared from good slag aggregate (½-in. to ⅛-in.), coarse washed river sand (⅛-in. to 200-mesh), and limestone filler (◀200-mesh), with a high aromatic tar having an equiviscous temperature of 50° to 60°C. The original specification requirements were as follows:—I. Stone, 35 per cent.; sand, 50 per cent.; filler, 15 per cent.; binder (50°C. E.V.T.), 7.5 per cent. II. Stone, 38 per cent.; sand, 50 per cent.; filler, 12 per cent.; binder (50°C. E.V.T.), 8 per cent. III. Stone, 50 per cent.; sand, 38 per cent.; filler, 12 per cent.; binder (50°C. E.V.T.), 6.5 per cent. for trunk roads, 7.0 per cent. for city streets. The materials were mixed in a modern low- and medium-temperature asphalt plant which had accurate weighing devices for aggregate and binder and in which the aggregate was heated to the required mixing temperature of 200° to 250°F. The operation of the plant was closely controlled. The mixed material, which was tipped on delivery at the site, was barrowed into position, spread with heated forks to a compacted thickness of 2 in. (rate of spread about 10 sq. yd./ton), and rolled (usually with a 10- to

12-ton steam roller, but a 6- to 8-ton reversing roller would be preferable). On some roads the material was laid directly on to the unprepared existing surface, on others the original surface was first reshaped by burning off or scarifying and re-rolling. The effects of certain variations in composition on the performance of the surfacings were compared with the findings of the laboratory investigation. The following main conclusions are drawn from the work:—(1) Although insufficient time has elapsed to enable the ultimate life of the surfacing to be estimated, the results so far indicate that dense tar surfacings can form a satisfactory road surface for the heaviest traffic, including military tanks. (2) The characteristics of the filler used have an important effect on the properties of the surfacing. The full-scale work confirmed the laboratory conclusions that (a) although for maximum resistance to deformation the proportion of filler must be above a certain minimum, no advantage is gained by using a filler content greater than 30 per cent. of the filler-sand mixture, and (b) an important indication of the value of a filler is given by its bulk density in benzene. (3) The optimum binder content calculated according to the methods given by Lee and Rigden corresponds closely to the content found to give on the road the surfacing most resistant to deformation. For normal traffic, the binder content may with advantage be a little higher than the calculated optimum: with a binder content slightly below this optimum, the surfacing is more resistant to indentation, but may be unsatisfactory in other respects. (4) The most suitable viscosity for the binder is 50° to 60°C. E.V.T. (5) The nature and the grading of the fine aggregate affect the binder content required by the mixture. (6) For satisfactory results, thorough compaction during laying is essential, which may preclude the laying in winter, except by experienced labor, of surfacings containing binder of 60°C E.V.T. —*The Surveyor*, London. Abstracted by "Road Abstracts."

Activated Silica for Winter Use of Activated Carbon

SOME users of activated carbon for taste and odor control have found that carbon particles pass through the filters during the winter season, although this does not occur at other times of the year. The explanation is the fragile nature of floc formed in cold weather, when it is so weak as to break up and pass into the clear well and therefore cannot hold the carbon particles on or in the filter. The passage of carbon through the filters is more noticeable than that of the alum floc and thus serves a useful function as an indicator of a condition which needs correction. The remedy, however, is not to abandon carbon treatment, but rather to improve the coagulation to assure retention of the carbon and the coagulated impurities in the sedimentation basin or in the filters. In this manner taste and odor control can be obtained together with a coagulation efficiency which assures a low alum residual.

An increasing number of water plants are using activated silica to strengthen alum coagulation, producing a faster forming, quicker setting and tougher floc. The employment of activated silica for this purpose as developed by J. R. Baylis consists of toughening the alum floc by the use of sodium silicate (water glass) which has been partially neutralized

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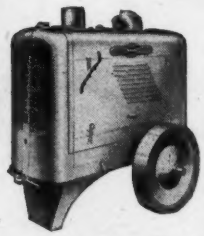

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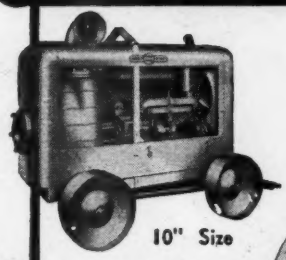

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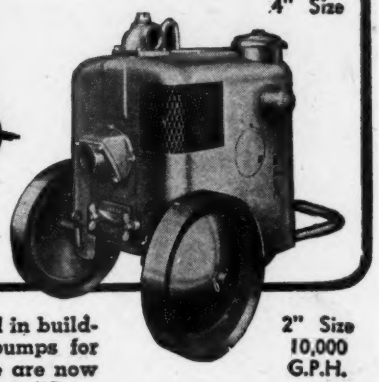

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with sulfuric acid. This process has been installed in the new Chicago South District Filtration Project, the world's largest water treating plant. It is also used by several other large cities such as Des Moines, Iowa; Kansas City, Kansas; and several smaller cities and industrial water plants. Other silicate methods have been developed by A. V. Graf and W. B. Schworm of the city of St. Louis, Mo., and by the Philadelphia Quartz Company. In these, the sodium silicate is reacted with alum, ammonium sulfate, or chlorine. A large number of treatment plants scheduled for post-war construction will utilize the now well-established silicate processes.

Studies by Baylis proved that coarse sand and high rates of filtration can be used without sacrificing water quality by employing a silicate process. During February, March, and April it was shown that less than one-twentieth as much turbidity passed filter sands ranging from 0.6 to 1.1 mm effective size when the silicate treatments were used as when alum alone was the coagulant. With the silica it was possible to reduce the amount of alum consumed so as to offset the silicate cost and show a 5% saving. This economy might not hold for all plants, however, since the quantity purchase of silicate at a large plant is a favorable factor. (Plants using silicates for both coagulation and corrosion control often benefit from quantity purchase.) More important than chemical savings, however, was the fact that reduced construction costs were possible as a result of higher flow rates through the plant.

While a rather free experimental approach can be taken in the application of activated carbon the same does not apply to activated silica. The latter must be activated at the point of use and requires reasonable control to obtain maximum benefits. In addition there are factors in plant use which need advance consideration. Preliminary laboratory studies should be made to determine the response of the water to the silicate processes. Care should be taken that the water samples are treated at the same temperature as the supply.

When beneficial effects are noted in jar tests, time should be given to a thorough study of the silicate processes and a consulting engineer or sodium silicate manufacturer who has had extensive experience with the silicate processes should be consulted.

The above is abstracted from an article by H. R. Hay, Chemical Dept., Philadelphia Quartz Co., in *Taste and Odor Control Journal*.

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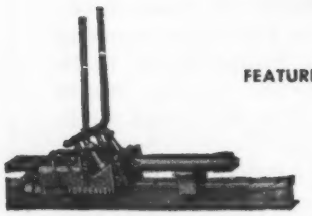

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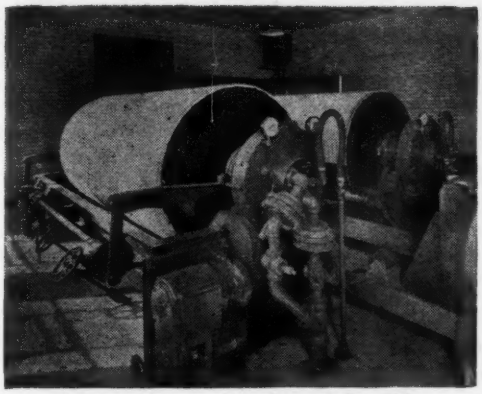


Vacuum filters at Cuyahoga Falls, Ohio.

The Sewerage Digest

Abstracts of the main features of all important articles dealing with sewerage and sewage treatment that appeared in the previous month's periodicals.

Treating Ground Garbage With Sewage

In Minneapolis, the ten-year average contribution of garbage was 0.47 lb. per capita per day, 60% greater during August and September; the average moisture content being 80%. It is estimated that if this be ground and added to the sewage, the suspended solids in the latter would be increased by 18%—23% during August and September. Only two cities have had experience with treating ground garbage added to sewage, neither of which employed chemical treatment or vacuum filtration. Apparently a somewhat higher percentage of removal by sedimentation is caused by addition of garbage.

Applying the results of investigation to conditions at the Minneapolis-St. Paul plant, it was concluded that addition of ground garbage would:

1. Increase the material contained in the sewage an average of 18% during the year and a maximum of approximately 25% during the critical months of August and September.
2. Increase the quantity of solids which must be disposed of and produced by the sedimentation tanks, about 45,000 pounds per day or approximately 22% as an annual average.
3. Increase the amount of treatment which must be provided in this plant by chemical treatment when a higher degree of treatment is necessary than can be provided by sedimentation, from an average of 57% removal of BOD to 65%.
4. Increase the maximum degree of treatment required under the severest river conditions from 82% without the addition of ground garbage to 83.7%.
5. Entail, if all garbage were ground, an expenditure of approximately $96,000 for added facilities to handle such increased load, and added operation and maintenance costs of approximately $87,000 annually. The total added annual charges, including fixed charges on additional investment is estimated at $93,000 annually.
6. Increase the cost of sewage treatment per capita from $.37 annually to $.48.
7. Involve an expenditure of approximately $.55 annually for sewage treatment per grinder installation.[H50*]

Porous Tube Air Diffusers

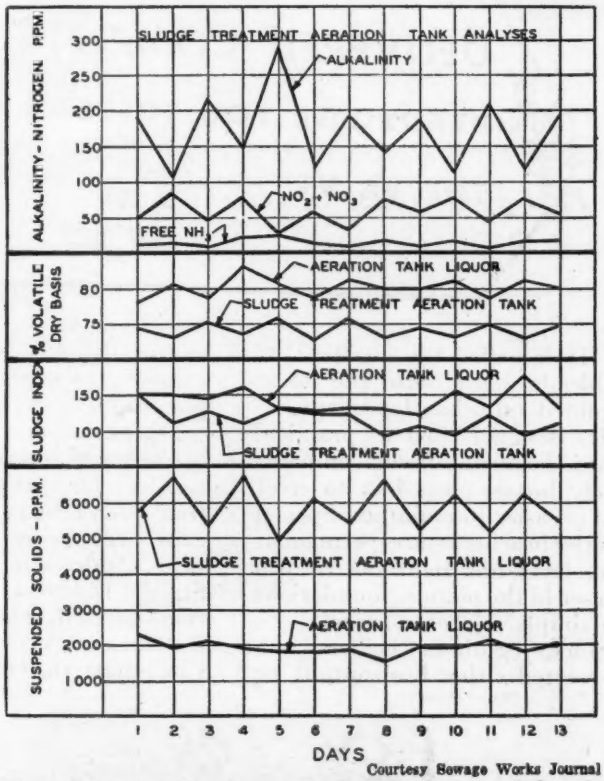
There are some 400 activated sludge diffused-air installations in the United States, of which 40% to 50% use porous tubes. The most efficient arrangement of these tubes is at right angles to the axis of the tank, giving the so-called "wide band" diffusion.

Advantages claimed for tubes over diffuser plates are: The actual contact volume of the rising stream of air bubbles from tubes is more than twice the volume from plates. There is a greater detention time in the case of tube diffusion. There is a better tank circulation characteristic with "wide band" diffuser tubes than with horizontal diffuser plates. The modern diffuser tube system eliminates center coring in aeration tanks because a greater volume of the tank contents is constantly rolling. The location of tube diffusers 2 ft. above the bottom of the tank saves 7 to 10% of blower power required. The Sanitary District of Chicago is conducting comparative studies of the economic advantage of diffuser tube aeration over horizontal diffuser plate aeration.

Specifications for porous media compare them on the basis of dry permeability, while wet pressure loss is the important factor in design. The author therefore suggests an addition to standard specifications, providing that "The diffuser tubes shall have a head loss such that when they are tested submerged in water with a temperature of 70°F plus or minus 2° and with air at a temperature of 70° plus or minus 5°, the head loss through the diffuser tube and adaptor together with the flow controller or orifice which go to make up a diffuser tube assembly shall not be more than—inches of water pressure at a flow rate of 4 cfm per tube, nor more than—inches of water pressure at a flow rate of 8 cfm per tube.[C76*]

Use of Digested Sludge In Activated Sludge Treatment

A method of control of the sludge index of activated sludge has been developed at Peoria, Ill., by the use of digested sludge, either bottom sludge or supernatant liquor. It was found that when digested sludge is mixed



Courtesy Sewage Works Journal

Effect of low rate interchange on alternate days on sludges in aeration tanks and sludge treatment aeration tanks with continuous addition of digested sludge.

*See Bibliography in November issue.

with activated sludge in the proper proportions and aerated, the mixture becomes an activated sludge which has a sludge index that is approximately the weighted average of the indices of the two sludges prior to mixing and aeration.

In order to introduce the digested sludge into the activated sludge system without adding load to the aeration tanks, the digested sludge is first converted to activated sludge in a sludge treatment aeration tank, after which it is interchanged with the activated sludge in the normal activated sludge portion of the plant, by withdrawing part of the return sludge from the final settling tanks and adding it to the sludge treatment tank and adding the sludge treatment tank overflow to the normal return sludge. (The illustration indicates the conditions in both the aeration tanks and sludge treatment aeration tank while digested sludge is being added to the sludge treatment tank continuously.)

It was found, under the varying load conditions at the plant, that the most satisfactory method was one of continuous addition of digested sludge and a low rate interchange made on alternate days. The intermittent interchange was considered more desirable than the continuous interchange due to the desire to separate the activated sludge in the aeration tanks and the sludge treatment aeration tanks into two batches so that if a "shock" load caused loss of clarification in the aeration tank activated sludge on one day, clarifying properties could be restored rapidly by the interchange of the two sludges on the following day.[E93]

Activated Sludge Treatment

In 1940 there were 297 activated sludge plants in operation in this country with an approximate capacity of 1700 mgd. During the war some were installed at military establishments. From 28 years' experience more or less standard bases of design have emerged. These must be related to the degree of treatment required and the characteristics of the sewage-temperature, age, strength, and sharp variations of these and other factors. Adjustment of the displacement period, the return sludge, the solids in the aeration tanks and the quantity of air are adaptable procedures. Much progress has been made in developing lower construction and operating costs. There is much room for development in both design features and stabilizing operation. Improved mechanical equipment for cleaning air effectively and economically is desirable. Present methods of air diffusion and efficiency of air use are not fully satisfactory and improved means for restoring the effectiveness of clogged diffusers are needed. Several variations of final sedimentation tank design are being considered. Testing and control procedures are being studied with a view to more stable operation and further economies.[C90]

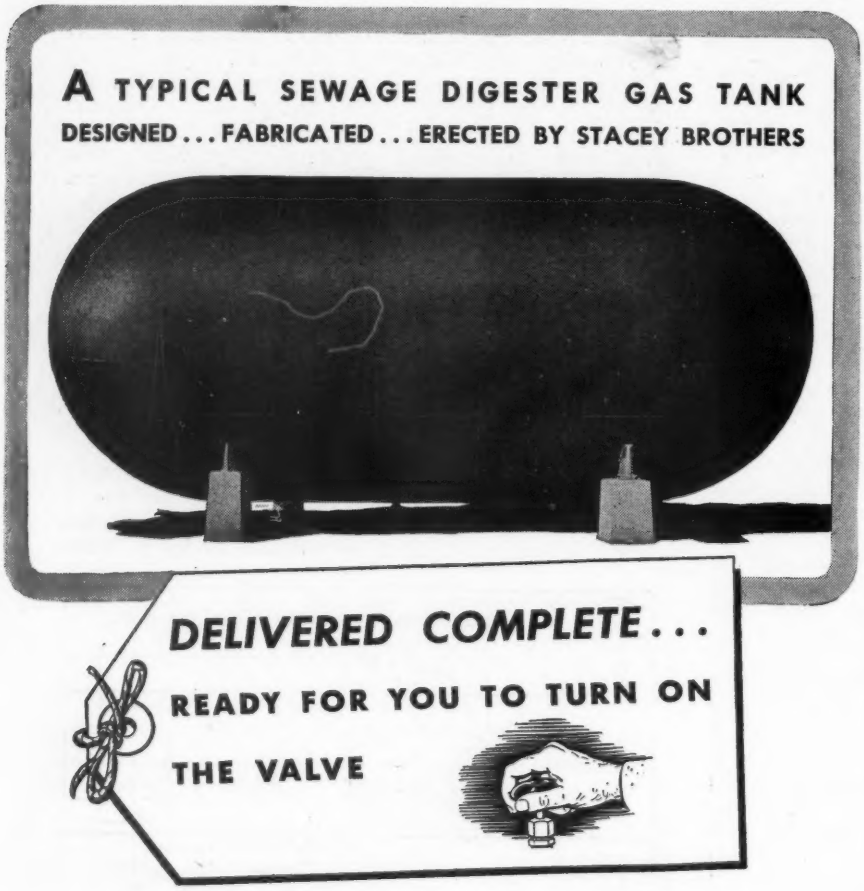
Locating Groundwater Infiltration

Infiltration of ground water into 3.5 miles of 8" and 10" vitrified pipe with poured bitumastic joints, which had not yet been put into use, was found to be 93,312 gpd, or 26,600 gal. per mile. Specifications called for infiltration not to exceed one gallon per hour per inch diameter per 100 ft. of sewer.

To locate the points of greatest infiltration, the flow at the outlet was measured. By plugging the sewer in successive manholes and measuring the flow, the maximum rate of infiltration was located in a 480 ft. length between MH No. 1 and MH No. 2. To locate it more definitely, a pear-shaped punching bag was inflated to make a tight fit in the 10" pipe, was thoroughly greased, and was drawn through the sewer, by means of sash cord, by 20 ft. increments. The decrease in flow was uniform as the bag was drawn down the sewer, indicating leakage throughout the entire line. When this was relaid with a tight sewer, the flow for the entire 3.5 miles was reduced to the specified limit.[C80]

The Future of Trickling Filters

The use of high-rate filters will increase where the ultimate in purification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is not required but where a better effluent than that produced by sedimentation alone is necessary. Where a well purified effluent is called for, standard-rate filters will be provided more and more with means for recirculation of effluent. Experiences at Plainfield, N. J., and San Bernardino, Calif., point the ways by which improved operating results may be obtained with standard filters.

There are a number of questions relative to trickling filters for which conclusive answers remain to be obtained. For example, in the case of recirculation, the best points to take and to discharge recirculated liquor have not been definitely demonstrated.[C81*]

Disposal of Pickling Liquors

In pickling steel, use is made of sulfuric, hydrochloric, nitric, phosphoric, and hydrofluoric acids, but sulfuric more than all the others combined. Thus far, the possibility of realizing a financial profit from the treatment or disposal of waste pickle liquor is not at all promising. Most of the processes which have been operated on a pilot-plant scale and which afford marketable by-products are costly or are not adaptable to operation in the mills.

Water purification and sewage and industrial waste treatment provide large potential markets for iron salts. Combination of copperas with activated silica is said to give excellent results as a sewage coagulant, avoiding the necessity for chlorinating the copperas. Further plant-scale tests with iron salts should be conducted to establish the conditions under which they are better or more economical than other coagulants.[C82*]

Freezing Cannery Wastes

Routine sampling of canning wastes showed that after freezing there was reduction of BOD from 2,000 ppm to 500 and sometimes as low as 30; also marked reduction in total and suspended solids and volatile matter, with a marked increase in the settleable solids. Studies of freezing corn cannery wastes led to conclusions that, in freezing, solids are thrown out of solution and suspension and precipitated, only a small fraction of the precipitated solids going back into solution. Settleable solids may be increased as much as 10,000% over those found in the original unfrozen sample. The solids thrown out of solution settle rapidly, leaving a relatively clear supernatant. Broad, shallow lagoons make possible the freezing of a larger portion of the waste than do deep ones, afford conditions more favorable for the penetration of sunlight, and present a greater surface area for reaeration.[C83*]

Effect of Plating Wastes on Digestion

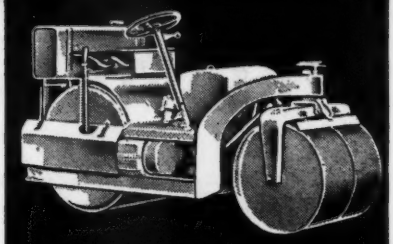
Investigation of the effect of polysulfide-treated case hardening, copper and zinc plating solutions on sludge digestion indicated that a material concentration of each of them could be tolerated by the sludge digestion process, these concentrations varying from daily additions of 200 ppm for the copper plating solution to 1200 ppm for the carburizing solution. All wastes increased the H_2S content of the digester gas because of the calcium polysulfide, a basic constituent of each waste. Because so small a part of the sewage flow reaches the digesters, the digestion would not be materially affected if the sewage carried a concentration of less than 60,000 ppm of carburizing solution, 30,000 ppm of zinc plating solution or 10,000 ppm of copper plating solution.[C84*]

Sodium Nitrate For Cannery Wastes

It is the writer's opinion that, when using sodium nitrate in lagooning wastes, better results can be obtained if sanitary sewage, or effluent from septic tanks at the canning plant, are allowed to discharge into the lagoon with the plant wastes so as to stimulate bacterial growth

*See Bibliography in November issue.

C. H. & E. CONSTRUCTION EQUIPMENT



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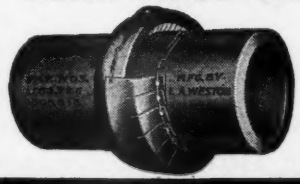

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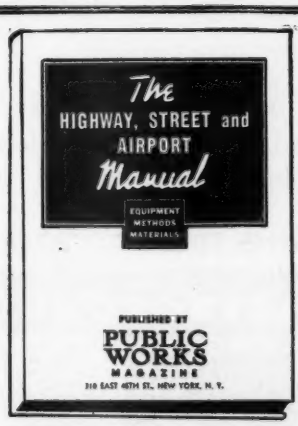

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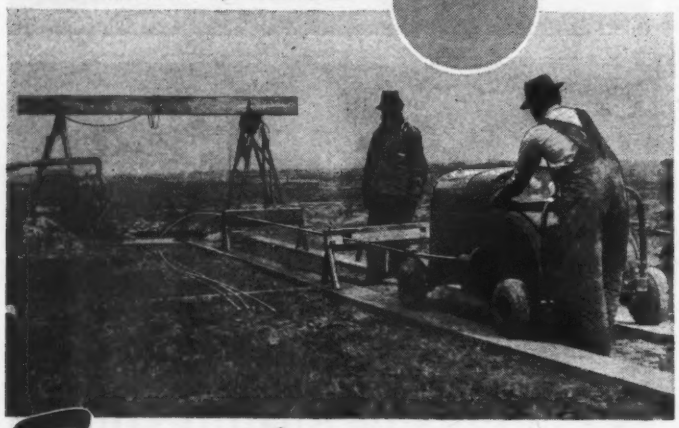

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by seeding. This is particularly true in the case of potato, beet or carrot wastes from plants using caustic soda in the peeling process, because such wastes are almost sterile. A laboratory test on a lye peel beet waste showed that sewage addition was required to simulate lagoon conditions where soil bacteria are present.

If pea stack juice is allowed to enter the lagoon with process wastes, additional sodium nitrate must be added.

Sodium nitrate contains 56.4 lb. of available oxygen per 100 lb. and in addition yields 19.3 lb. of ammonia through reduction of the nitrate. The ammonia is useful in control of pH and in holding volatile compounds in solution; also it neutralizes the organic acids present in vegetable and fruit juices.[C96]

Bibliography of Sewerage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. indicates construction article; *n*, note or short article; *p.* paper before a society (complete or abstract); *t*, technical article.

C *Sewage Works Journal*
November

90. The Development of the Activated Sludge Method of Sewage Treatment. By Samuel A. Greeley. Pp. 1135-1145.
91. Ten Years' Operation of the West Middlesex Works at Mogden, England. By C. B. Townsend. Pp. 1146-1173.
92. Comparison of Analyses of Composite Samples Collected Over 8, 16 and 24 Hours. By Arthur D. Caster and Robert C. Hamilton. Pp. 1174-1176.
93. The Use of Digested Sludge and Digester Overflow to Control Bulking Activated Sludge. By L. S. Kraus. Pp. 1177-1190.
94. Rising of Activated Sludge in Final Settling Tanks. By Clair N. Sawyer and Leland Bradney. Pp. 1191-1209.
95. Control of Sludge Index by Chlorination of Return Sludge. By John A. Tapleshay. Pp. 1210-1226.
96. Experiences with Sodium Nitrate Treatment of Cannery Wastes. By William A. Ryan. Pp. 1227-1230.
97. Better Sewers. By Benjamin Eisner. Pp. 1231-1233
98. Theory and Operation of Separate Sludge Digestion Units. By L. L. Langford. Pp. 1235-1240.
99. Operation of Sludge Drying and Sludge Gas Utilization Units. By LeRoy W. VanKleeck. Pp. 1240-1255.
100. Operation of Activated Sludge Plants. By Gail P. Edwards. Pp. 1255-1266.

D *The Surveyor*
October 12

34. Surface Water Sewer Design. By A. F. Brennand. Pp. 601-604.
35. *p.* Sewerage and Sewage Disposal in Retrospect and Prospect. By M. Lovett. Pp. 607-609.

October 19

36. Efficient Detritus Settlement at Comparatively Small Sewage Treatment Works. By L. B. Escritt. Pp. 635-637.

November 2

37. *p.* Treatment of Settled Sewage by Continuous Filtration With Recirculation of Part of the Effluent. By E. V. Mills. Pp. 653-657.
38. Winter Difficulties at Sewage Disposal Works. By John Hurley. Pp. 659-662.

G *Water Works & Sewerage*
October

22. Replacing a Digester Valve. By Robert C. Urban. Pp. 307-308.

H *Sewage Works Engineering*
November

57. *c.* Concrete Resurfaced to Ward Off Acid Attack in Sewage Plants. By Joseph Doman. Pp. 558-561.
58. 14,000 Plants Beautify Grounds at Sewage Works-Incinerator. By Walter Capwell. Pp. 562-563.
59. Primary Treatment Chosen for Maine Corps Camp. By Carr & J. E. Greiner Co. Pp. 568-569.
60. Sewer Infiltration Troubles. By E. B. Warren. P. 575.

J *American City*
November

13. Scum-Free Sludge Digesters. Pp. 100-101.

M *Water and Sewage*
October

15. Construction Progress on Toronto Sewage Treatment Plants. Pp. 15-20, 62.
16. Compilation of Sewage Works Data. By William L. Havens and Frank Woodbury Jones. Pp. 21-27, 50.
17. Single-Residence Septic Tanks. By A. C. Peterson. Pp. 24-26, 46.
18. Sewage Treatment at Detroit. Pp. 28-29, 54.

P *Public Works*
November

51. Operation of Sedimentation Basins. By R. C. Merz. Pp. 17-19, 32.
52. Winter Operation of Sewage Filters. Pp. 23-24.
53. Financing Sewage Disposal. Pp. 27-28, 36.
54. Producing Formalin From Sewage Digester Gas. Pp. 42-44.

Racine, Wisconsin, filter room.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

Water and Sewage Rate Schedules

Few rate schedules have a rational basis, but all should have. Most are simply copied from those of near-by communities or developed by trial and error from obscure beginnings. In some cases, rates are lowered if there is general complaint by consumers, or raised if there are no complaints.

"The basis of any rational rate schedule should be an up-to-date inventory and appraisal of all real and personal property and operating capital, which should be revised periodically." Annual fixed charges should be correctly related to a reliable present-day valuation of the property, real and personal, that is at the service of the rate payers. The rates should include "readiness-to-serve" charges calculated to yield the total of the fixed financial expenses justifiably chargeable, plus consumption charges calculated to yield the total of the operating expenses. The author recommends readiness-to-serve charges to include all fixed financial expenses and a rate of return of 5½% on net worth.[A118]

Chemical Laboratory As a Detective

The laboratory of the Pasadena, California, Water Department has been used to solve a number of problems not connected with purification control. In one case flooding of a basement was blamed on a leak in the water distribution system, but analysis of the flooding water showed that it differed widely from the city supply in magnesium-calcium ratio, in sodium and chloride content and otherwise.

In another case, analysis of water escaping through a street pavement indicated that it was from a water main, and that the leak was a short distance up hill from its emergence through the pavement, since the chlorine residual of 0.05 ppm had not decreased. It was found less than 15 ft. away.

The source of high iron content in the city's chief supply stream was traced by taking the pH of the stream at intervals from the reservoir up into the hills, locating the effluent from a bog rich in Crenothrix, the pH of which was 6.2 instead of the normal 8.3 of the stream.[A121]

Maintenance of Plant Equipment

Failure of equipment is generally the result of either (1) ordinary wear and tear, (2) accident, or (3) neglect. The first can be postponed by careful and intelligent operation. The third is probably the greatest single cause of trouble and is inexcusable.

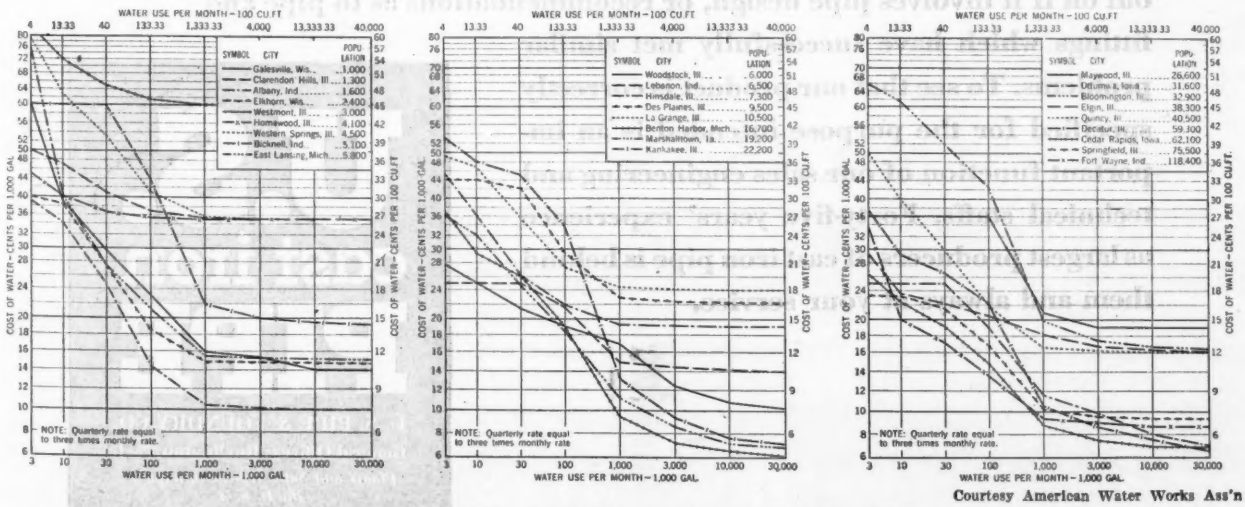
The best results in operation of any plant can be obtained only if 1. The equipment is best of its kind, of capacity properly adapted to its intended use and expertly installed. In short, no misfits and nothing but expert installation.

2. Members of the operating staff are intelligent, loyal, interested in their work and competent.

3. The maintenance crew is composed of full-time, competent, experienced mechanics, who are loyal and eager and who take pride in keeping equipment in perfect operating condition, and who are fully supplied with tools, test meters, gages and any testing equipment necessary to keep close check on all equipment.[A122]

Electrical Pumping

The motor-driven centrifugal pump has displaced the old steam pump because it is only a fraction of the size and can be purchased for a fraction of the cost. But the


WATER USE PER MONTH – 100 CU FT
COST OF WATER – CENTS PER 1,000 GAL
COST OF WATER – CENTS PER 100 CU FT
WATER USE PER MONTH – 1,000 GAL
NOTE: Quarterly rate equal to three times monthly rate.
SYMBOL CITY POPULATION
Galesville, Wis. 1,000
Clarendon Hills, Ill. 1,300
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Homewood, Ill. 4,100
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East Lansing, Mich. 5,800
Woodstock, Ill. 6,000
Lebanon, Ind. 6,500
Hinsdale, Ill. 7,300
Des Plaines, Ill. 9,500
La Grange, Ill. 10,500
Benton Harbor, Mich. 16,700
Marshalltown, Ia. 19,200
Kankakee, Ill. 22,200
Maywood, Ill. 26,600
Ottumwa, Iowa 31,600
Bloomington, Ill. 32,900
Elgin, Ill. 38,300
Quincy, Ill. 40,500
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Courtesy American Water Works Ass'n

Water rates in cities, grouped by population into three classes.

Lithographed on stone by Edward A. Wilson

Illustration shows installation of cast iron flexible joint subaqueous pipe line specified for the required service conditions. How to do it when you get the go-ahead is a problem we are always glad to help out on if it involves pipe design, or recommendations as to pipe and fittings which have successfully met similar problems. To see that our product is correctly specified for the purpose intended is an important function of our sales engineering and technical staffs. Forty-five years' experience as largest producers of cast iron pipe is behind them and always at your service.

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electrical supply may be interrupted; the head-capacity characteristic is not well adapted to waterworks pumping; and the basic laws governing change of speed make this an uneconomical method of changing rate of delivery. A common method of reducing delivery rate is by throttling the discharge valve, preferably a plug or cone valve. A combination of a variable-speed unit and two or more constant-speed units is often satisfactory.

There are three available methods of varying speed: 1—Using steam turbines with reducing gears; 2—use of wound rotor or slip-ring motor direct connected to the pump; 3—use of a synchronous motor connected to the pump through a variable speed hydraulic coupling. The efficiency of either 2 or 3 decreases in proportion to the reduction in speed. No. 3 is a relatively new development.[A124]

Troubles With Iron in Well Waters

The author describes two instances in which odor, taste and color were caused by iron, and iron deposits formed in the well and the distribution system, abundant bacteria of the Crenothrix variety being present. In one case chlorine was discharged at a point in the well near where the water entered the pump, and in a few days all taste and odor disappeared and bacterial growths disappeared.

In the other case, sulfate-reducing bacteria and algae choked the slots in the well screen. Chlorine did not remove them but prevented increase, and those present were removed by surging. After the surging, the water level rose much more rapidly than before on stopping the pump, indicating that the ground formation for some distance around the well had to be cleaned also.

He concludes that a biological analysis should be made of every well water containing iron in solution, and if iron bacteria are found they should be destroyed at their source.[A125]

Predaceous Beetles in Reservoirs

The water supply of Winnipeg, Manitoba, receives no treatment other than chlorination, with occasional use of copper sulfate and activated carbon. In October 1944, for the first time, predaceous beetles appeared in the distribution system by the thousands, some as much as 3" long. The water supply is distributed through both closed and open reservoirs, and the beetles were found in the latter but none in the former. The open reservoirs were emptied, washed and swept clean, and refilled, and no more beetles appeared until March 1945, when they began to appear and the reservoir was again cleaned June 17th. It was believed that they flew into the reservoir from the surrounding country. Cleaning the reservoirs is only a temporary solution, but as they had not appeared before for 25 years of operation, the trouble would appear to be cyclic and expensive changes not warranted. They appear to be unaffected by chlorine, copper sulphate or potassium permanganate.[A130]

Controlling Pests in Reservoirs

The most common pests in reservoirs are larvae of the midges (Chironomids). Prevention or elimination of these may be by mechanical, biological or chemical procedures. Small reservoirs can be covered and all openings screened to keep out the midges. Filters of excelsior or sponge, through which water must pass into the distribution system, have been successful with cyclops and daphnia.

Biological methods include keeping down vegetation in the vicinity of the reservoir (which harbors midges); preventing algae (food for the larvae) in the reservoir; and stocking the resorvoir with fish.

Of chemical methods tried, it is found that the Chironomid larvae will withstand either copper sulphate or chlorine concentrations up to 50 ppm, but disappeared three days after applying 0.01 ppm of DDT. At Peoria, Ill., Acme White Oil mixed with oleic acid, 2 gal. to a 15 mg reservoir, has been used with success since 1940.[A129]

A Griffin Wellpoint Job!

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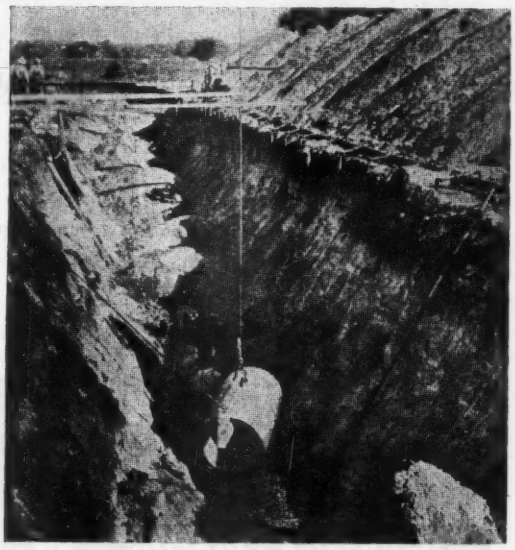
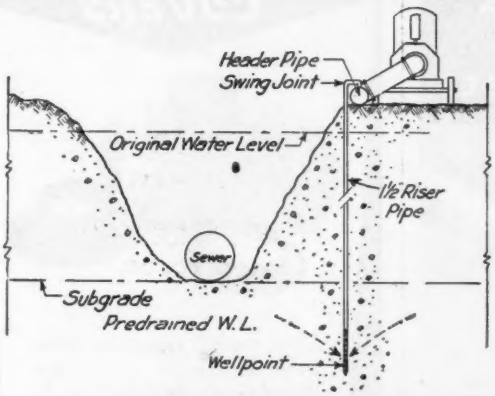
eliminated sheeting and

TRIPLED DAILY PROGRESS



The Contractor planned this sewer pipe job for tight sheeting and open pumping. *He averaged 50 feet daily.* Then 3 weeks of heavy rain raised ground water level to within 3 feet of the surface in the 15-foot cuts.



They immediately rented a three-pump GRIFFIN WELLPOINT SYSTEM, with a purchase option. After installation, they eliminated all sheeting for the entire job. Upon completion of the work, they had *averaged 150 feet per day.* They took up their option and bought the GRIFFIN WELLPOINT SYSTEM to start it again on another contract. For lower installation, operation and maintenance costs—it's GRIFFIN every time.

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Bibliography of Waterworks Literature

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c. indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Assn.*
November

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4. The Conservation and Legal Control of Ground Water. Pp. 1-5.

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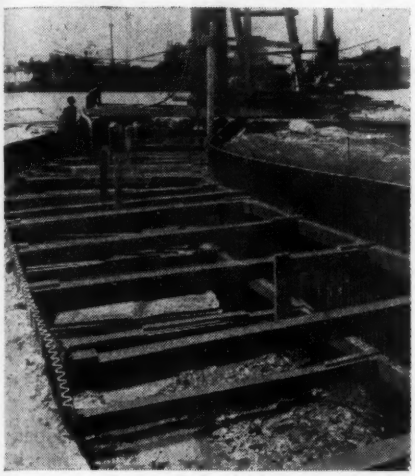
Keeping Up With New Equipment

New Name for Caine Piling

Because the name Corrugated Steel Sheet Piling has caused some misunderstanding of its structural characteristics, the Caine Steel Company has renamed the product, Caine *Corr-Plate* Steel Piling.



Trench with Caine Corr-Plate steel sheet piling.

This piling is made by corrugating steel plates, thereby giving the piling the greatest strength possible per pound weight of steel and high section modulus.

Caine *Corr-Plate* is the only corrugated piling which is cold-rolled, similar to other steel shapes. It's made on special machines, the only ones of their kind.

This piling is now made in two types. The sections of the "Interlock" type are applied by raising them high enough above the completed section of piling, to hook in from the top. The "Standard" type is so arranged that the section being applied is hooked into welded clips from the side, making its use possible in places where there is low head room—under a bridge or other similar overhead obstructions; or where there is unlimited head room, but the job is adaptable to application from the side, which speeds up the work, cuts application costs and is reusable.

Caine *Corr-Plate* Steel Piling is rolled and sold by Caine Steel Company, 1820 N. Central Ave., Chicago 39, Ill.

Improved Concretes Through Controlled Air

New features and advantages in concrete mix are obtained through the use of Darex Aea at the mixer, which gives controlled air in concrete from the mixer to the finished job. Tests show that the air content remains uniform after the initial mix, thus permitting long hauls of ready-mixed conrete without the continued whipping in of excessive air. Other advantages accruing from controlled air are increased workability, increased resistance to thaw and freezing, and a resulting plasticity which makes for an improved finish in the concrete.

Complete details on the method of application and use of this air entraining agent have now been published and engineers interested in more durable concretes may secure copies of the new booklets upon request to the Dewey and Almy Chemical Company, Cambridge, Mass.

City of Louisville Buys Late Type Garbage Trucks

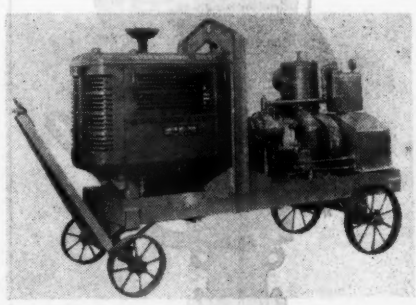
Living conditions in American cities have steadily improved with the progressive adoption of modern, high efficiency equipment. This is noticeable in all municipal departments. It is particularly evident in the handling and disposal of garbage.

A good example of this trend to better handling of garbage is found in the City of Louisville which recently purchased six of the latest type White Super Power Trucks equipped with all-enclosed metal bodies.

The all-enclosed bodies are of the semi-automatic loading type, having a capacity of 13 cubic yards. They are Gar Wood bodies, closely tailored to the requirements of garbage collection. Painted in white, the vehicles radiate a pleasing atmosphere of sanitation.

A New Addition to the Wellpoint Equipment

Model 108-D, 10 x 8, Vac-U-Matic Wellpoint Pump powered with an International UD-9 engine. Due to increased horsepower, this model pump now delivers 2800 GPM—300 GPM greater than its former rating powered with gasoline engine.



Vac-U-Matic wellpoint pump.

As all wellpoint pumps operate continuously 24 hours per day, the application is particularly suited to the use of a Diesel engine. However, the Griffin Wellpoint Corporation is the first dewatering company to offer this feature as a standard pump in its line, not only for sale but also for rental on the larger wellpoint jobs.

In addition to Diesel power and larger pump capacity, many mechanical improvements are now incorporated, particularly the elimination of all packing in the stuffing box.

Latest type White Super Power Trucks with Gar Wood all-enclosed metal bodies.

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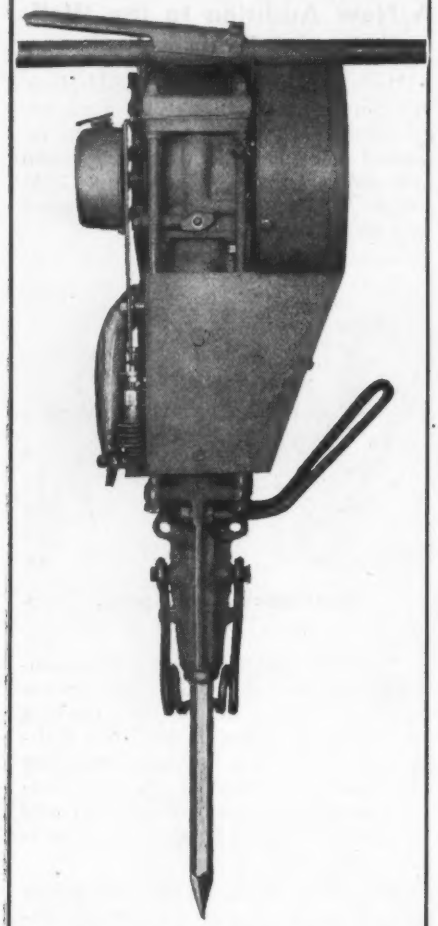

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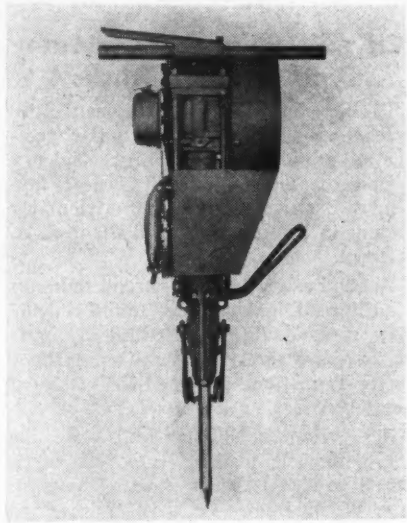
Catalogue, "Griffin Pointed Wellpoint Facts," is available upon request. Write Griffin Wellpoint Corp., 881 East 141st St., New York 54, N. Y.

Self-Contained Gasoline Hammer Paving-Breaker

The Syntron Company, 660 Lexington Avenue, Homer City, Pa., announces an improvement in the design of the tool retaining arrangement of its Self-Contained, Portable Gasoline Hammer Paving Breaker.

The nose-end arrangement has been redesigned to utilize the resiliency of a spring-tool retaining clip, as illustrated. This eliminates the solid latch mechanism previously employed and commonly used in this type of demolition Hammer for retaining the Tool in the hammer. The advantages of the resilient spring clip arrangement are threefold.



Syntron's gas hammer paving breaker.

First, providing easy spring action of the tool itself when used at maximum over-travel. Second, providing a quicker and easier method of changing tools used in the Hammer. Third, the elimination of broken retainer latches, nose castings, etc., because of a lack of resiliency in the retaining arrangement.

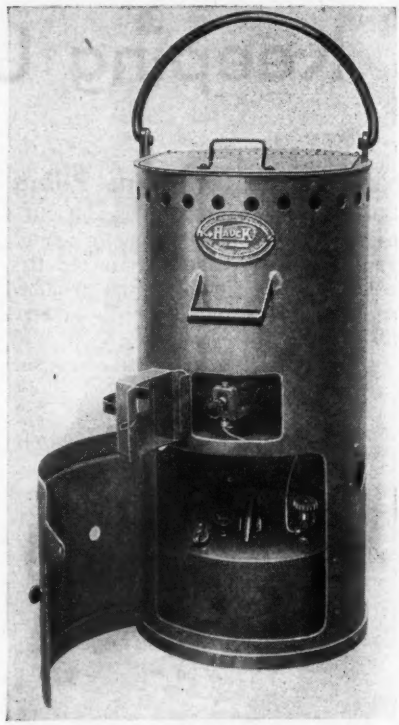
Additional information about these Gas Hammer Paving Breakers—the tools to be used with them—and the various uses to which they can be put —is available from the company upon request.

A New Furnace for Melting Pipe Joint Compound

Hauck Compound Melting Furnaces for heating and melting pipe joint compound are a radical departure from ordinary furnaces.

Getting away entirely from the blow torch type flame, these furnaces have a single gasoline burner with a soft, clean, blue flame, instantly and easily adjustable to any point from minimum to maximum heat output.

The flame and its control are similar to the domestic stove gas burner in that



Hauck compound melting furnace.

no preheating is necessary. Simply open the valve, light the burner with a match and adjust to desired flame size.

Furnished in two popular sizes, the larger has a one bag (120 lb.) capacity and the small size for service installations and repairs having 60 lb. capacity. Pots are heavy steel, better than cast iron because they heat up faster and absorb less heat, therefore less likely to overheat compound.

Construction streamlined with built in windshield making furnaces suitable for all weather operation.

Write to Hauck Manufacturing Company, 124-136 Tenth St., Brooklyn 15, New York for full description.

International Harvester Company Establishes Program for Training Employes

Fowler McCormick, President announces the establishment within the company of a new, comprehensive program of education and training, and a cooperative arrangement with the University of Chicago for the development and carrying out of a thorough program for the better instruction of its many thousands of employes.

"It is our intention to expand International Harvester's training facilities in order to develop a better understanding among employes of our company's many and diversified activities, and to enhance their welfare by enabling them to have effective, specialized, and intensive training for increased responsibilities within the organization," Mr. McCormick said in explaining the objectives of the new educational and training program.

To assist the company in developing this large program, a cooperative agreement between the Harvester Company

and the University of Chicago has been entered into. This agreement, which was arranged by the Director of Education of the Harvester Company through the University's Business Problems Bureau, calls for grants to the University totaling $125,000 to finance the first five years of its participation in the joint venture.

Commenting on the University's role in the unprecedented program, Chancellor Robert Hutchins said:

"The University of Chicago has agreed to furnish International Harvester with the advice and counsel of specialists in adult and business education, and to appoint to its faculty a full-time director of the cooperative project."

A. C. Seyfarth will direct the educational program at International Harvester, while William M. Shanner, formerly an examiner at the University of Chicago and recently released from his duties on the staff of the Chief of Naval Air Training, will be director of the University's project.

Fairbanks-Morse Appoints New Distributors in Northwest

The Seattle Branch of Fairbanks, Morse & Co., has appointed the Milwaukee Machinery Co., of Portland, Oregon, as exclusive distributor for the complete line of Fairbanks-Morse Turbine Pumps, including the Fairbanks-Morse Pomona Pump and the Fairbanks-Morse Oil Lubricated Turbine Pump. They are also going to handle service and sales for Fairbanks-Morse Niagara Propeller and Mixflow Pumps as well as Fairbanks-Morse Westco Horizontal Turbine Type Pumps.

Their Pump Department will be headed up by Mr. W. H. Perry, who was with the Dallas Branch of Fairbanks, Morse & Co., for many years.

The Cascade Machinery Co., of Seattle, Washington will handle all Fairbanks-Morse Pumping equipment including Pomona Pumps and Westco Pumps. This firm will also act as distributors for Fairbanks-Morse motors and electrical equipment.

The service department of Cascade Machinery Co., includes a machine and fabrication shop which can handle all types of repairs on both pumping and electrical equipment.

The Pump Department will be managed by Clyde A. Retter who was recently employed at the Seattle Branch of Fairbanks-Morse and for many years before that as district manager for the Pomona Pump Co., before it was purchased by Fairbanks, Morse & Co.

Yeomans Brothers Company Doubles Factory Space

By signing a long-term lease on the two-story building at 937 West North Avenue, Yeomans Brothers Company, manufacturer of pumps and sewage treatment equipment, has doubled its production capacity, it is announced by Charles Yeomans, president. After modernization, the additional space will house the small pump and sewage treatment sections and the service department; and additional personnel will be required to handle increased production.

"With the lifting of material controls and other wartime restrictions, demand for pumps of all kinds, for industrial and domestic uses, has increased sharply," stated Mr. Yeomans.

Dresser Manufacturing Division Appoints Sales Manager

The appointment of Hanford Z. Hight as Sales Manager of Dresser Manufacturing Division, Bradford, Pa., is announced by Hector P. Boncher, General Manager.

For the past three years Mr. Hight has served with the United States Navy as an Air Combat Intelligence officer. His last duty was aboard the escort carrier, U.S.S. Shipley Bay, attached to the Third and Fifth fleets during the Okinawa operation.

Prior to his service with the Armed Forces, Mr. Hight was District Manager of Dresser Manufacturing Division in the mid-west territory.

H. E. Cotton, Drainage Engineer, Dies

Harry E. Cotton, 64, drainage engineer with Armco Drainage & Metal Products, Inc., died suddenly of a heart attack on October 12, 1945, at Middletown, Ohio.

One of the many exclusive features of the Frink is that it eliminates the snow packing itself into the adjoining snow as it is carried to the side. This prevents side thrust. The snow is first raised on the forward portions of the moldboard, above the level of the banks, before it is carried to the sides. Write today for more detail on the Frink special features.

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DAVENPORT-BESLER CORP., DAVENPORT, IOWA
FRINK SNO-PLOWS OF CAN. Ltd., TORONTO, ONT.

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

Cotton was known throughout the United States and Canada for his investigational work and planning of highway and airport drainage. He was consulted by many highway departments and his advice was sought on drainage for important military and civilian air bases. During the war he lectured on drainage at Harvard University in connection with special airport drainage classes for the Army Air Forces. He was also thoroughly versed in hydraulics, sewer design and load research problems.

M. F. Sasgen Elected President of Sasgen Derrick Co.

At the board meeting in Chicago, on August 31, directors of the Sasgen Derrick Company elected M. F. Sasgen as president and treasurer to succeed his father, the late Michael J. Sasgen. Mr. Sasgen has for many years been vice-president and general manager of the company and his election as president insures continuation of the policies and trade relations established by his father.

J. A. Armstrong Joins Syntron Co.

The Syntron Company, Homer City, Pennsylvania is pleased to announce the appointment of Mr. J. A. Armstrong as District Manager of the Company's sales and engineering service on their line of Vibratory Material Handling equipment for the State of Michigan, with the exception of the Detroit Metropolitan Area, with headquarters in Lansing. He will also supervise the sale of Syntron Portable Electric Tools and Self-Contained, Gasoline Hammers in the same area.

Mr. Armstrong comes to the Syntron Company with a wide experience in machinery and equipment design and installations work, and the Syntron Company's many customers will benefit by his association with the company.

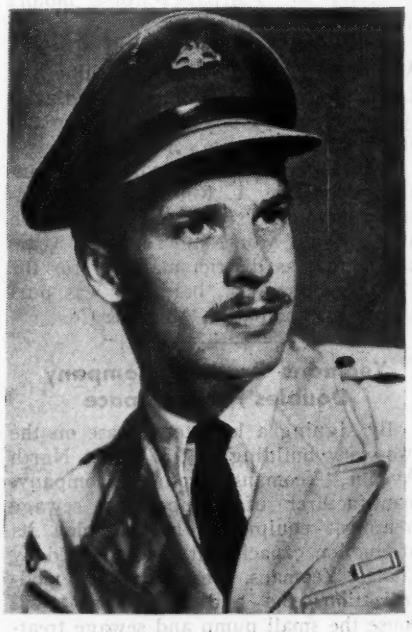
New England Metal Culvert Co. Appoints Consulting Engineer

Alfred J. Runnals, Road Engineer for the Vermont Department of Highways since 1925, has just accepted a position as consulting engineer for the New England Metal Culvert Company of Boston. This company is associated with Armco Drainage & Metal Products, Inc., Middletown, Ohio.

Runnals is well qualified for his new position, having a wide background of experience with various highway and roadway problems. For 20 of his 25 years with the Vermont Department of Highways he had charge of all highway location and design, the preparation of plans and contracts and general coordination of construction work. His association with the State saw Vermont's highways emerge from virtually "horse and buggy roads" to the present modern, improved highways.

Ralph B. Carter Co. Promotes Horgan and Appoints Sales Engineers

J. W. Van Atta, Vice President and General Manager of the Ralph B. Carter Company has promoted J. J. Horgan to the position of Assistant Sales Manager. Mr. Horgan has been associated with the Ralph B. Carter Company since 1938, serving as Sales Engineer in the Sanitary Division, covering the Northern New Jersey, New York State and New England territory. Previously he had served with Gibbs & Hill and Madi-



Ralph B. Carter III.

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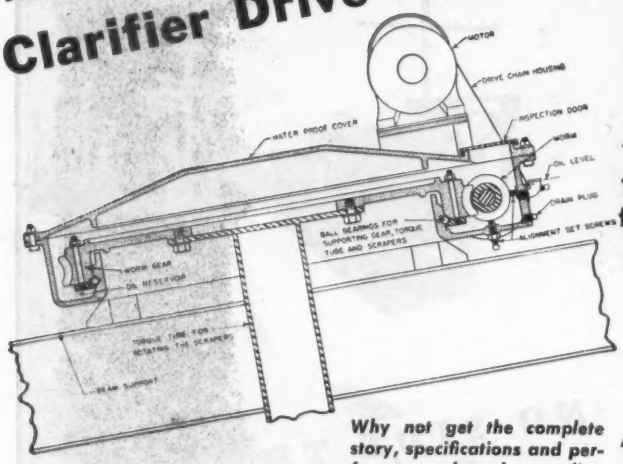

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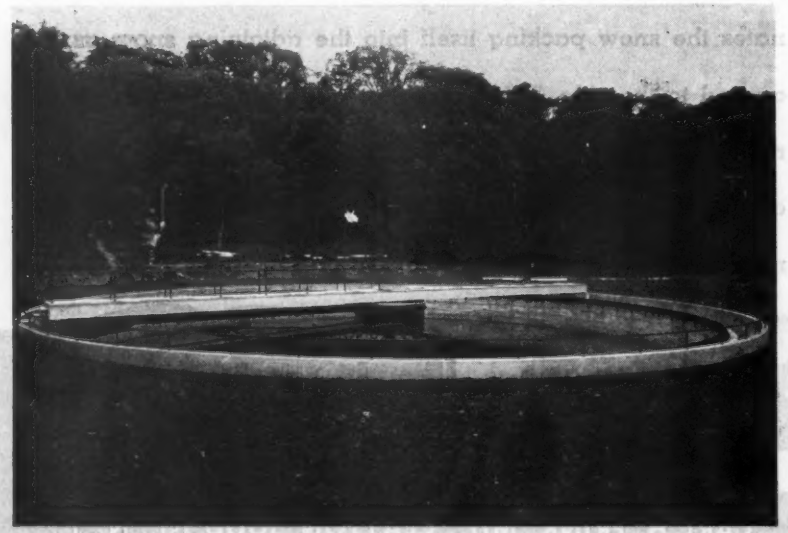


HARDINGE CIRCULAR CLARIFIERS

When you need special information—consult the classified READER'S SERVICE DEPT., *pages 71-73*

Lewis Klockner.

gan & Hyland, Consulting Engineers of New York City.

Other Sales Department developments in the Sanitation Division include the appointment as Sales Engineers of Lewis Klockner and Ralph B. Carter III, both recently discharged from overseas armed duty.

Captain Klockner served in the Sanitary Corps, and saw duty in North Africa, Italy and Corsica. He is a graduate engineer of Lafayette College and for ten years had been associated with the Bureau of Engineering of the New Jersey State Department of Health.

Ralph B. Carter III volunteered for overseas duty with the American Field Service. He was assigned to the Ambulance Corps, and saw action during the Central Italian and Appenine campaigns while attached to the British Eighth Army and was later transferred to the North German Theatre of operations with the British Second Army. Mr. Carter III is an alumnus of Philips Academy, Andover, Mass., and attended Yale University.

Welden Joins Metal Culvert Mfrs. as Engineering Director

Elmer C. Welden has been appointed Engineering Director of the Association of Metal Culvert Manufacturers in New England, comprising Bancroft and Martin Rolling Mills Co., of Portland, Maine; Berger Metal Culvert Co., of Somerville, Mass.; Penn Culvert Co., Somerville, Mass.; and New England Metal Culvert Co., of Boston, Mass.

His long experience in the highway field, thorough knowledge of drainage and stabilization problems, and wide acquaintance in New England make Mr. Welden well qualified for his new position.

Mr. Welden has a wide range of experience. One of the notable projects completed during Mr. Welden's service as Deputy Commisioner of the Connecticut State Highway Department was the Merritt Parkway. This highway set a new high standard in safety, efficiency and attractiveness. Other important projects during that period were the Hartford-East Hartford Bridge and the New London-Groton Bridge.

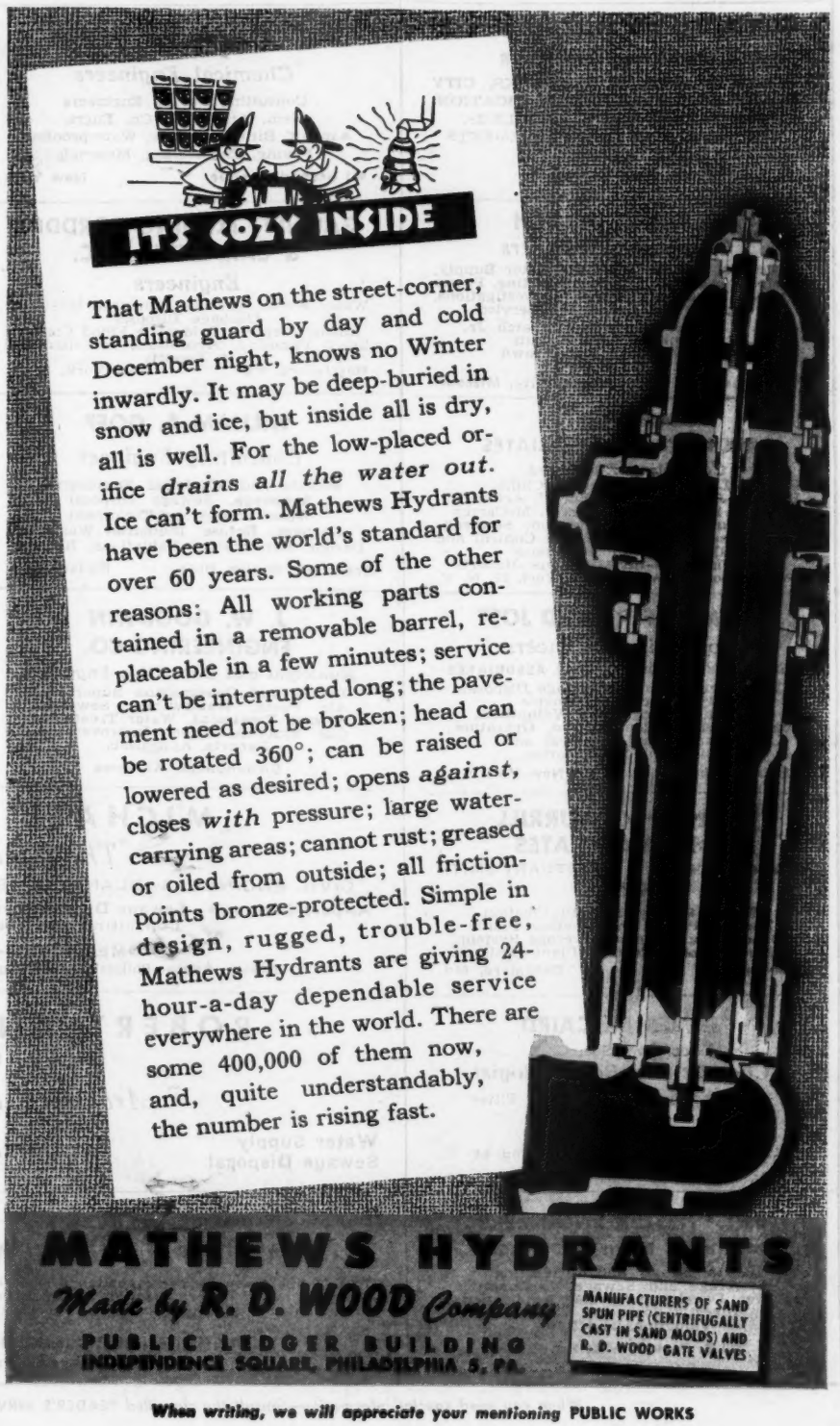
A. S. C. E. Appoints Public Relations Director

Inauguration of a public relations program by the American Society of Civil Engineers is announced by Colonel William N. Carey, Secretary and Executive Officer.

In making the announcement, Colonel Carey stated the 93-year-old engineering society will endeavor to make the general public more familiar with civil engineers and their work nationally and in their respective communities.

"We feel there is an interesting story to be told of the engineers' work in the war and of their essential part in the all-important reconstruction task now being undertaken throughout the world," Colonel Carey said.

To inaugurate and conduct the program, Allen Wagner, public relations director of Minnesota Mining and Manufacturing Company, with headquarters at St. Paul, Minnesota, has been named public relations assistant to Colonel Carey. He will carry on his work from the Society's headquarters, 33 West 39th St., New York City.


IT'S COZY INSIDE
That Mathews on the street-corner, standing guard by day and cold December night, knows no Winter inwardly. It may be deep-buried in snow and ice, but inside all is dry, all is well. For the low-placed orifice *drains all the water out.* Ice can't form. Mathews Hydrants have been the world's standard for over 60 years. Some of the other reasons: All working parts contained in a removable barrel, replaceable in a few minutes; service can't be interrupted long; the pavement need not be broken; head can be rotated 360°; can be raised or lowered as desired; opens *against*, closes *with* pressure; large water-carrying areas; cannot rust; greased or oiled from outside; all friction-points bronze-protected. Simple in design, rugged, trouble-free, Mathews Hydrants are giving 24-hour-a-day dependable service everywhere in the world. There are some 400,000 of them now, and, quite understandably, the number is rising fast.
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CONVENTIONS

January 14-18 . . . American Road Builders' Association will hold its forty-third annual convention at the Stevens Hotel in Chicago.

January 15 . . . New York Section, American Water Works Association. Annual Luncheon Meeting at Hotel Pennsylvania, New York, N. Y. Secretary-Treasurer, R. K. Blanchard, 50 West 50th Street, New York 20, N. Y.

January 16-18 . . . American Society of Civil Engineers. Annual Meeting, Hotel Commodore, New York, N. Y. Secretary, William N. Carey, 33 W. 39th Street, New York 18, N. Y.

January 18 . . . New York State Sewage Works Association. Annual Meeting, Hotel Pennsylvania, New York, N. Y. Secretary-Treasurer, A. S. Bedell, c/o State Department of Health, Albany, N. Y.

January 21-24 . . . Purdue Road School. Annual Road School, Memorial Union Bldg., Purdue University, Lafayette, Ind. R. B. Wiley, School of Civil Engineering, Purdue University, Lafayette, Ind.

January 25-28 . . . Highway Research Board. The 25th Annual Meeting, Skirvin and Skirvin Tower Hotels, Oklahoma City, Oklahoma.

February 26-28 . . . Conference on Highway Engineering. Annual Meeting, Hotel Pantlind, Grand Rapids, Mich. Secretary, R. L. Morrison, University of Michigan, Ann Arbor, Mich.

March 28-29 . . . New York Section, American Water Works Association. Spring Meeting, to be held at Mark Twain Hotel, Elmira, N. Y. Secretary-Treasurer, R. K. Blanchard, 50 West 50th Street, New York 20, N. Y.

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Water and Sewage Works Manufacturers Assn. Elects Board of Governors

At the Annual Meeting of the Water and Sewage Works Manufacturers Association, Inc., held at Hotel Pennsylvania, New York, N. Y., Oct. 24, 1945, five (5) new members were elected to the Board of Governors to serve for a term of three years, namely.—Dresser Manufacturing Division, Engineering News-Record, General Electric Company, Johns-Manville Corp., and Simplex Valve & Meter Co.

Accordingly, for the fiscal year ending October 31, 1946, the Board of Governors will be composed of—The Barrett Division, George B. McComb; The Dorr Company, Inc., R. S. Rankin; Dresser Manufacturing Division, H. P. Boncher; Engineering News-Record, Albert E. Paxton; General Electric Company, S. W. Corbin; Hersey Manu-

(Continued on page 74)

Readers' Service Department

These booklets are FREE but distribution is restricted to those actively engaged in engineering or construction. Use the coupon or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Air Compressors

1. New bulletins describe and illustrate LeRoi Portable Compressors in sizes from 60 to 500 c.f.m., gasoline or Diesel powered on mountings to fit your special needs. Same manufacturer makes both compressor and engine. Write LeRoi Company, 1770 So. 68th St., Milwaukee 14, Wis.

2. Complete catalog of Jaeger air compressors made in sizes 60 to 500 cu. ft.; trailer, truck, tractor and stationary mounted, gas, Diesel and electric power. Force feed lubrication, lifetime construction and many other advanced features included issued by The Jaeger Machine Co., 400 Dublin Av., Columbus 16, O.

Blades and Cutting Edges

12. Blades of all widths, lengths and thickness, punched ready to fit any type of machine you operate. Special steel gives extra wearing quality. Write for special bulletin and be sure to mention name of machine you operate. Shunk Manufacturing Co., Bucyrus, Ohio.

Cold Mix Plants

15. New catalogs and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, Ohio.

Concrete Accelerators

31. New 48-page booklet in five sections explains clearly the effects, advantages and methods of using Calcium Chloride and Portland Cement mixes. Complete and packed with practical information; well illustrated; pocket size. Sent free on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Concrete, Early Strength

38. 64-page manual tells how to speed up year 'round concreting, shows how to secure high early strength and greater workability at temperatures either below or above freezing. Contains many actual examples of practical concreting operations; well illustrated with more than 60 photos, charts, graphs and tables. Calcium Chloride Assn., Penobscot Building, Detroit 26, Mich.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Concrete, More Durable

50. How cement dispersion assures improved concrete with impressive economies in initial constructon costs and maintenance costs is the subject of new literature available from The Master Builders Co., 7016 Euclid Ave., Cleveland 3, Ohio.

Derricks

65. Guy Line and Stiff-Legged Derricks, "A" Frame Derricks, Setter Derricks, Pole Derricks and other hoisting and winch equipment are illustrated and described in catalog issued by Sasgen Derrick Co., 3101-3127 W. Grand Ave., Chicago 22, Ill.

Drainage Products

70. Standard corrugated pipe, perforated pipe and MULTI PLATE pipe and arches — for culverts, sewers, subdrains, cattlepasses and other uses are described in a 48-page catalog entitled "ARMCO Drainage Products," issued by the Armco Drainage Products Association, Middletown, Ohio, and its associated member companies. Ask for Catalog No. 12.

Graders, Patrol

98. The Austin-Western 99M Power Grader with its powerful all wheel drive simplifies all construction and maintenance; handles difficult jobs with economy and efficiency; and does better work on grading, ditching, scarifying, snow plowing, loading, mixing, bulldozing, shoulder trenching and backsloping. Write for Bulletin 1946. Austin-Western Co., Aurora, Ill.

Industrial Power

100. International power units in both diesel and carburetor types provide money saving power for many purposes. Send for latest catalog. International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

Joints, Contraction

101. How to get the highest contraction joints at least cost. Ask Highway Steel Products Co., Chicago Heights, Ill., to send you a folder on "Keylode" Contraction Joints.

Joints, Expansion

102. Para-Plastic hot-poured rubber joint sealing compounds, Premoulded Asphalt Expansion Joint, Premoulded Fibre Expansion Joint, Premoulded Cork Expansion Joint, Premoulded Cork Rubber Expansion Joint, Self-Expanding Cork Expansion Joint, Premoulded Sponge Rubber Expansion Joint and Waterstop Expansion Joint are described and illustrated. Write Servicised Products Corporation, 6051 W. 65th St., Chicago 38, for a copy.

Loaders

104. Jaeger Fleet Foot Loader, Crane, Excavator, in sizes ½ yd. to 2 yd. is described in new illustrated catalog. Full 180° swing allows loading trucks from both sides. For your copy write The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, O.

Memorial Plaques

105. Enduring Bronze honor roll, war memorials, etc., for public places. For descriptive literature address C. H. Buck & Co., 99 Chauncey St., Boston, Mass.

Mechanized Pavements

106. Devices for preventing random cracks in concrete pavements—expansion and contraction joints, longitudinal joints, translode joints, are described in 78 page well illustrated catalog. Write Highway Steel Products Co., Chicago Heights, Ill., for a copy.

Mud-Jack Method

107. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee 10, Wis.

Parking Meters

110. Mark-Time Parking Meters, self-winding, simple, big dial meters are now available. Described in literature issued by M. H. Rhodes, Inc., 30 Bartholomew Ave., Hartford 6, Conn.

Power Shovels

113. The full line of Osgood power shovels, cranes, draglines, and clam shells is illustrated in detail and described in comprehensive booklets issued by The Osgood Co., Marion, Ohio.

Pumps

116. New illustrated catalog and specifications of Jaeger "Sure-prime" Pumps 1½" to 10" size, 3,000 to 240,000 GPH capacities. Also Jetting, Caisson, Road Pumps and Wellpoint Systems. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus 16, O.

117. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

118. 16 - page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee 12, Wis.

119. "Carter Self-priming Centrifugal Pumps," a new 12-page illustrated catalog, gives detailed description of construction, and includes complete information on pump sizes, ratings and dimensions. Ask for bulletin #4310. Address: Ralph B. Carter Co., Hackensack, N. J.

Road Building and Maintenance

126. Two and Four Wheel Scrapers, Bulldozers, Tamping Rollers, Winches, Hoists and Repair Towers are subject of special bulletins issued by Gar Wood Industries, 7924 Riopelle St., Detroit 11, Mich.

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

130. BG Maintainer, a powerful, speedy, low-priced machine for light road maintenance. Write for folder, Huber Mfg. Co., Marion, Ohio.

131. Speed Scoop. A versatile small scraper unit, ideal for emergency repairs. Illustrated folder issued by Huber Mfg. Co., Marion, Ohio.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St. Milwaukee 12, Wis.

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. The Hercules Roller Co., Bucyrus, Ohio.

141. Three - Wheel Rollers. Huber Automotive type rollers in 5 to 8 ton sizes and Huber 10 & 12 ton diesel rollers. New

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142. Tandem Rollers. Variable weight tandem roller with three speeds forward and reverse for new highway surfacing and old road conditioning. Huber Mfg. Co., Marion, O.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principles and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Spreader

187. Jaeger Paving equipment, including Mix-in Place Roadbuilders, Bituminous Pavers, Concrete Bituminous Finishers, Adjustable Spreaders, Forms, etc.—4 complete catalogs of latest equipment in one cover, issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus 16, Ohio.

Surface Consolidation and Maintenance

188. Detailed and illustrated presentation of the method and procedure in consolidated operations; explains how sub-soils can be conditioned to resist softening and frost-action; how surfacing can be consolidated to provide smooth all-weather riding surfaces; how they can be maintained so as to prevent disintegration and gravel loss. Write the Calcium Chloride Association, Penobscot Bldg., Detroit 26, Mich., for Bulletin No. 29.

Tractors

190. Complete details about four sizes of International Diesel Tractors are given in 48-page well illustrated catalog. Includes many distinctive features of design and construction. Write International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

Street and Paving Maintenance

290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments with completely submerged pumps, tool heaters, surface heaters, road brooms, portable trail-o-rollers, etc. These are all described in detail and illustrated. This modern and up-to-date equipment for blacktop airport and road construction and maintenance is based upon experience and engineering research over a period of 42 years. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Fire Apparatus

300. Detailed information and advice about specially engineered Ward LaFrance apparatus will be sent on request. Ward LaFrance Div., Elmira, N. Y.

Snow Fighting

Snow Plows

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

352. Fast, self-feeding spreaders for ice control and seal coating that replace end gate on any dump truck, operated by driver of truck, are illustrated in new bulletin issued by Flink Co., 506 Vermillion St., Streator, Ill.

353. The new Flink and spreader attachment that spreads sand faster from thinnest surfacing up to 2" layers and keeps a perfect edge is described in bulletin sent promptly by Flink Co., 506 Vermillion St., Streator, Ill.

354. Ice Prevention on Highways, Streets, and Airport Runways with Sterling "Auger Action" Rock Salt. An illustrated bulletin issued by International Salt Co., Inc., Scranton, Pa.

Sanitary Engineering

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

358. Air Valves are the subject of Rensselaer Bulletin Q in which Air Release as well as Air and Vacuum, types are described. Address: Rensselaer Valve Co., Troy, N. Y.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York 6, N. Y.

Activation and Aeration

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20 pp. illustrated. Sent on request to Norton Company, Worcester 6, Mass.

Bodies, Special Truck

375. Gar Wood Hoists, and Bodies for every requirement including special bodies for sanitary refuse collection and for street sprinkling are illustrated and described in a new catalog issued by Gar Wood Industries, 7924 Riopelle St., Detroit, Mich.

Chlorinators, Portable

379. Complete data on new portable chlorinator designed to meet emergency calls quickly and efficiently. Write Wallace & Tiernan Co., Inc., Newark 1, N. J.

380. "Emergency Sterilization Equipment," a new bulletin describing the advantages of Dual Drive Chlor-O-Feeders which can serve as either a permanent chemical feeder or as a portable emergency chlorinator. Order from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

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385. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

386. 32-page illustrated booklet explains how a city can clean its sewers and culverts with its own forces using the up-to-date Flexible Sewer Rod equipment. Illustrates and describes all necessary equipment. Issued by Flexible Sewer Rod Equipment Co., 9059 Venice Boulevard, Los Angeles 34, Calif.

387. Literature illustrating how cities, towns and villages using OK Champion Sewer Cleaners are doing a complete sewer cleaning job from street level. Three sizes of machines available in addition to full line of sewer rods and accessories. Issued by Champion Corporation, 4752 Sheffield Avenue, Hammond, Indiana.

Consulting Engineers

389. "Who, What, Why" outlines briefly the functions of the consulting chemist and chemical engineer. Covers various methods of cooperation, on different types of problems, with industry, with attorneys and with individuals. Foster D. Snell, Inc., 305 Washington St., Brooklyn, N. Y., will send a copy on request.

Corrosion Prevention, Water Tanks

390. "Preventing Corrosion of Steel Water Storage Tanks" is the subject of an interesting, illustrated bulletin issued by Electro Rust-Proofing Corp., Dayton 10, Ohio. Gives full description of Rustop System of prevention.

Corrosion Resistant Metal

391. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. The American Brass Company, 25 Broadway, New York.

Diesel Engines

395. Illustrated engineering data fully explains the operating economy and job adaptability of the new Viking Diesel Engines. Six and eight cylinder models for continuous duty or stand-by service. Write Sterling Engine Co., 1299 Niagara St., Buffalo 13, N. Y.

Engines

396. Full details of LeRoi engines for continuous or intermittent duty are given in new illustrated bulletins. Write LeRoi Co., 1770 So. 68th St., Milwaukee 14, Wis.

Feeders, Chlorine, Ammonia and Chemical

399. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators are available in a wide range of capacities for feeding all of the usual chemicals used in sanitation practice—manufactured by Wallace & Tiernan Co., Newark 1, N. J.

400. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

401. Gravimetric Feeder, Loss-in-weight type (formerly called batch type), measures and feeds dry or liquid materials by weight. Illustrated bulletin issued by Omega Machine Co., Inc., 96 Codding St., Providence 1, R. I.

Filters, Vacuum

403. For bulletins on Vacuum Filters for dewatering primary, activated, digested or chemical sludge, write The Conkey Co., 420 Lexington Ave., New York 17, N. Y.

Fire Hydrants

405. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M & H Valve & Fittings Co., Anniston, Ala.

406. See listing No. 438.

407. Fire hydrants which are flood-proof, easy to operate and service are described in Rensselaer Bulletin W, formerly known as "Coreys." Address: Rensselaer Valve Co., Troy, N. Y.

408. For a concise description and illustrations of the Improved MUELLER-COLUMBIAN Fire Hydrants, complete parts list and full directions for ordering—get the new folder just issued by Mueller Co., Chattanooga 1, Tenn.

Flow Meters

409. The primary devices for flow measurement—the orifice, the pilot tube, the venturi meter and others—and the application to them of the Simplex meter are described in a useful 24-page booklet (C42A). Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Gas Holders

412. The Stacey Brothers Gas Construction Company, designers and manufacturers of gas holders, has issued a 16-page bulletin which gives many helpful facts and detailed information on the development of corrosion—and how to combat it—in gas holders. A copy of this bulletin will be mailed to anyone sending their request to The Stacey Bros. Gas Construction Company, 5535 Vine St., Cincinnati 16, Ohio.

Gates, Valves, Hydrants

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

415. See listing No. 438.

416. Check valves of the Clear-Way, Quiet-Closing type which eliminate "Slam" are described in Rensselaer Bulletin V. Made in expanding outlet type, as well as straight-thru type for bolting direct to pump discharge. Address: Rensselaer Valve Co., Troy, N. Y.

417. Rensselaer Gate Valves of high tensile strength, corrosion resistant iron are described in Rensselaer Bulletin X. Address Rensselaer Valve Co., Troy, N. Y.

418. A new four-page folder on MUELLER-COLUMBIAN Gate Valves gives construction details, shows various type of gear drive mechanism available, and has handy check list of dimensional data. White Mueller Co., Chattanooga 1, Tenn.

419. Double-disc gate valves; hydraulically operated valves; air, check, flap and mud valves. Fire hydrants with sliding gate or balanced valve. A 32-page catalog. Ludlow Valve Mfg. Co., Inc., Troy, N. Y.

Gauges

421. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Generating Sets, Diesel

422. New booklet describes Sheppard Diesel Generating Sets that make low cost electricity from cheap fuel and give dependable service in the hands of any average operator. Write R. H. Sheppard Co., 250 Middle St., Hanover, Pa.

Laboratory Equipment

423. pH and Chlorine Control. A discussion of pH control and description of comparators, chlorimeters and similar devices. An 80-page booklet. W. A. Taylor & Co., 7301 York Road, Baltimore 4, Md.

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Meter Setting and Testing

431. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Meters, Venturi

432. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

433. "The Selection of Main Line Meters," a highly informative and useful presentation prepared by a competent engineer, J. C. Thoresen, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., 9 Codding St., Providence 1, R. I.

Meters, Water

434. "Watchdog" water meters, made in standard capacities from 20 GPM up; frost-proof or split case in household sizes. All parts interchangeable with present models of same manufacturer. For bulletins, write Worthington-Gamon Meter Co., 282-296 South St., Newark, N. J.

Pipe, Cast Iron

436. Handbook of Universal Cast Iron Pipe and Fittings, pocket size. 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York 16, New York.

437. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Pipe Pusher

444. One-man-operated Hydraulic Pipe Pusher pushes pipe through ground under streets, sidewalks, lawns and other obstacles. Pays for itself in man hours saved on first few jobs. For complete facts and prices, ask for booklet S-117. Greenlee Tool Co., 2042 Columbia Ave., Rockford, Ill.

Pipe, Transite

445. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York 16, N. Y.

Pipe Joints, Sewer

447. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Adams, Mass.

448. Asphaltic Sewer Jointing materials are described and instructions for using them are included in a folder. Premoulded Sewer Pipe Belt, a modern method of jointing, a faster installation on the job, and Tufflex, a cold trowelling plastic for Sewer Pipe joints are the products. Write Servicised Products Corp., 6051 W. 65 St., Chicago 38, Ill.

Pipe Joint Compounds

450. The uses of Tegul-Mineralead for bell and spigot pipe and G-K Sewer Joint compound are described in a 16-page illustrated booklet issued by Atlas Mineral Products Co., Mertztown, Pa. Includes useful tables for estimating quantities needed.

Pumps, Sludge

451. Plunger Sludge Pumps are described in bulletin #4502, just released for publication. This new eight-page catalog shows detail photos of construction of a Carter unit, and gives complete information including specifications, motor selection, capacities, dimensions, weights and sizes of the various single and multiple plunger pumping sets manufactured by the Ralph B. Carter Co., Hackensack, N. J.

452. Non-clogging, vertical or horizontal, dry pit or submerged: storm water and drainage pumps are described in several Bulletins; also sump and bilge pumps. Peerless Pump Div., Quincy, Ill.

Pumps and Well Water Systems

454. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

455. Peerless pumps in a variety of types, with oil or water lubrication and any power drive, to pump water from any depth are described and illustrated in new literature that clearly shows their construction and special features. Write Peerless Pump Div., Food Machinery Corp., 301 W Ave. at 26th St., Los Angeles 31, Calif.

456. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

457. Centrifugal Pumps of various designs—single-stage, double-suction, split casing; single-stage single-suction; two-stage opposed impeller; three-stage; high-pressure; fire pumps; close-coupled. A bulletin for each type. Peerless Pump Div., Food Machinery Corp., Quincy, Ill.

Screens

460. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straightline Bar Screens" (Vertical and Inclined types). Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

Sludge Drying and Incineration

462. "Disposal of Community Refuse by Incineration" is a handsome 34-page booklet that discusses incineration from a commonsense standpoint. Illustrated by numerous photos of typical installations and includes diagrammatic outlines of various plant designs. Write Morse Boulger Destructor Co., 207-P East 42nd St., New York 17, N. Y.

463 Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

Softening

466. This folder explains the process of Zeolite water softening and describes and illustrates the full line of equipment for that purpose made by the Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill. Includes flow charts, tables and other valuable data. Write for a copy of this instructive folder.

467. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in a technical booklet. Permutit Co., 330 W. 42nd St., New York 18, N. Y.

Sprinkling Filters

469. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

Swimming Pools

474. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

475. A new illustrated bulletin on Graver Swimming Pool Equipment. Especially valuable to municipal and consulting engineers for use in writing up swimming pool specifications. Issued by Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill.

Taste and Odor Control

476. "Taste and Odor Control in Water Purification" is an excellent 92-page, illustrated booklet covering sources of taste and odor pollution in water supplies and outlining the various methods of treatment now in use. Every water works department should have a copy. Write Industrial Chemical Sales Div., 230 Park Ave., New York 17, N. Y.

477. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark 1, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

479. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago 13, Ill.

480. New booklet (No. 1642) on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia 40, Pa.

481. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewerage and water plants. Contains layout drawings, installation pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

482. "Sedimentation with Dorr Clarificers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

483. A combination mechanical clarifier and mechanical digester. The Dorr Clarigester is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

484. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York 22, N. Y.

485. New illustrated folder on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

488. "Packaged" Sewage Treatment Plants, specifically developed for small communities—100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2438 Wolfram St., Chicago 18, Ill.

489. Illustrated and described in detail in this bulletin, the new Carter Improved Flocer presents an entirely new method of controlled flocculation without paddle agitation. Write Ralph B. Carter Co., Hackensack, N. J.

490. New bulletin fully describes and illustrates Hardinge sludge collectors for clarifiers, sludge concentration and skimming in both circular and rectangular tanks. Write Hardinge Company, Inc., York, Pa.

Underdrains, Trickling Filter

492. Illustrated bulletin describes the Natco Unifilter block of glazed, hard burned clay for underdraining filter beds. Write National Fireproofing Corp., Pittsburgh 12, Pa., for free copy.

Valves (See Gates, Air Release, etc.)

Water Treatment

495. If you have a water conditioning problem of any kind, write Graver Tank & Mfg. Co., 332 So. Michigan Ave., Chicago 4, Ill., who manufacture all types of conditioning equipment and will be pleased to make recommendations.

496. "Use of copper sulphate in water treatment plants" titles informative booklet, with valuable data on chemicals, dosage, etc. Write Tennessee Corporation, Atlanta 1, Ga.

497. Ferri-floc Ferric Sulphate—a new, valuable booklet on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

499. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Stuart-Brumley Corp., 516 No. Charles St., Baltimore, Md.

Water Service Devices

506. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., will be sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

Wellpoint Systems

508. Catalogue, 60 pp., with many job illustrations describing the use of a Wellpoint System in dewatering construction projects. Complete illustrations and descriptions of wellpoint pumps, wellpoints, header lines and fittings, jetting pumps and hose. Griffin Wellpoint Corporation, 881 East 141st Street, New York 54, N. Y.

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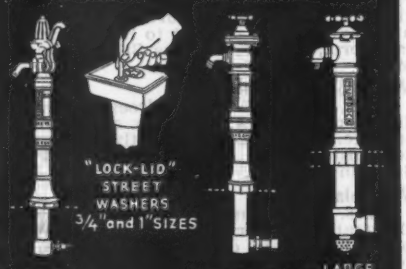

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(Continued from page 70)

facturing Co., William C. Sherwood; Hydraulic Development Corp., R. F. Hayes; Johns-Manville Corp., Charles A. McGinnis; Link-Belt Company, Frank W. Lovett; Lock Joint Pipe Co., F. F. Longley; National Water Main Cleaning Co., Clinton Inglee; The Permutit Company, Daniel J. Saunders; Pittsburgh Equitable Meter Co., W. F. Rockwell; Simplex Valve & Meter Co., Everett N. Jones; Wallace & Tiernan Co., Inc., William J. Orchard.

Immediately following the Annual Meeting, the Board of Governors convened and elected William C. Sherwood, Secretary of Hersey Maufacturing Company, as President and Albert E. Paxton, Publisher of Engineering News-Record, as Vice President.

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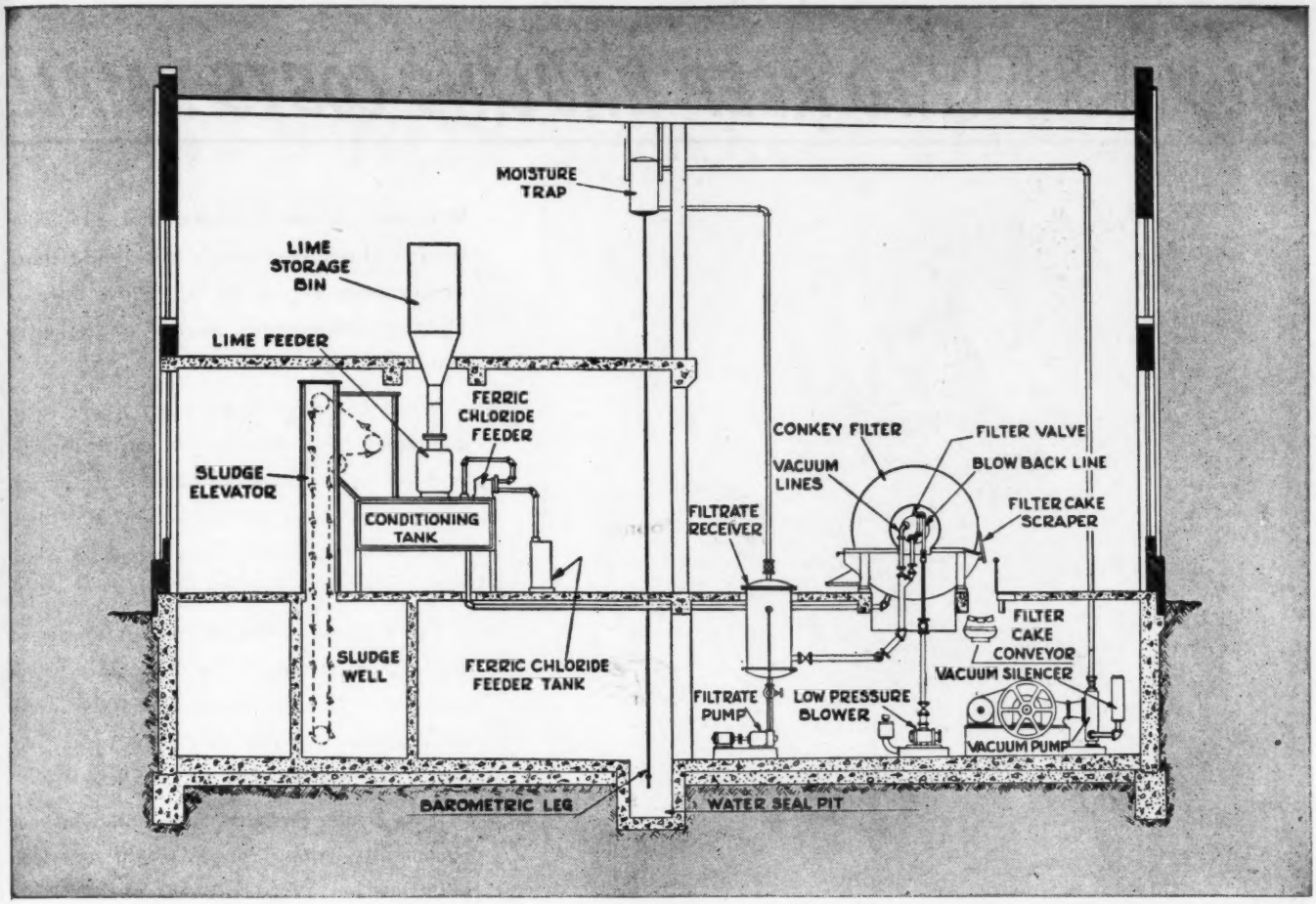

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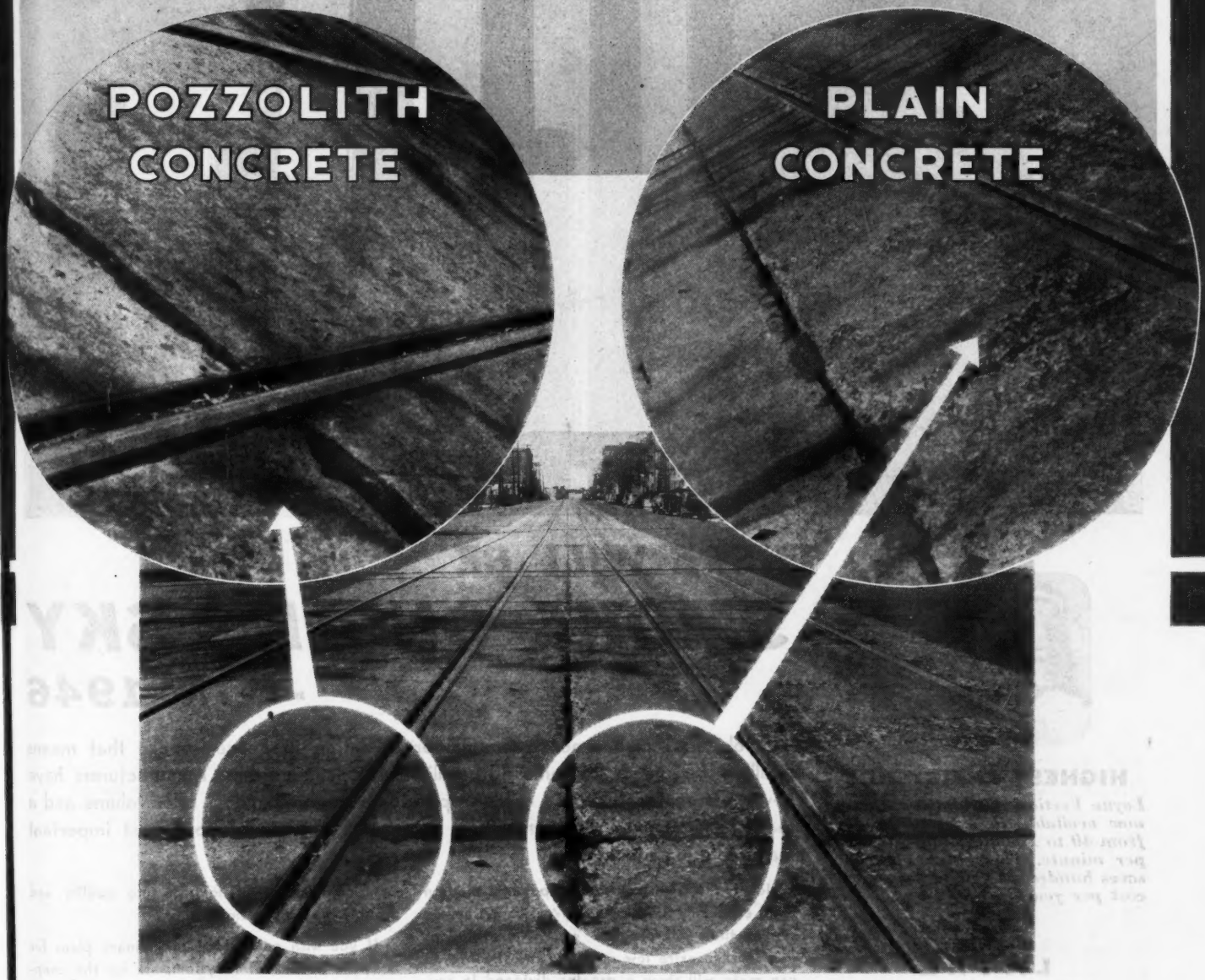

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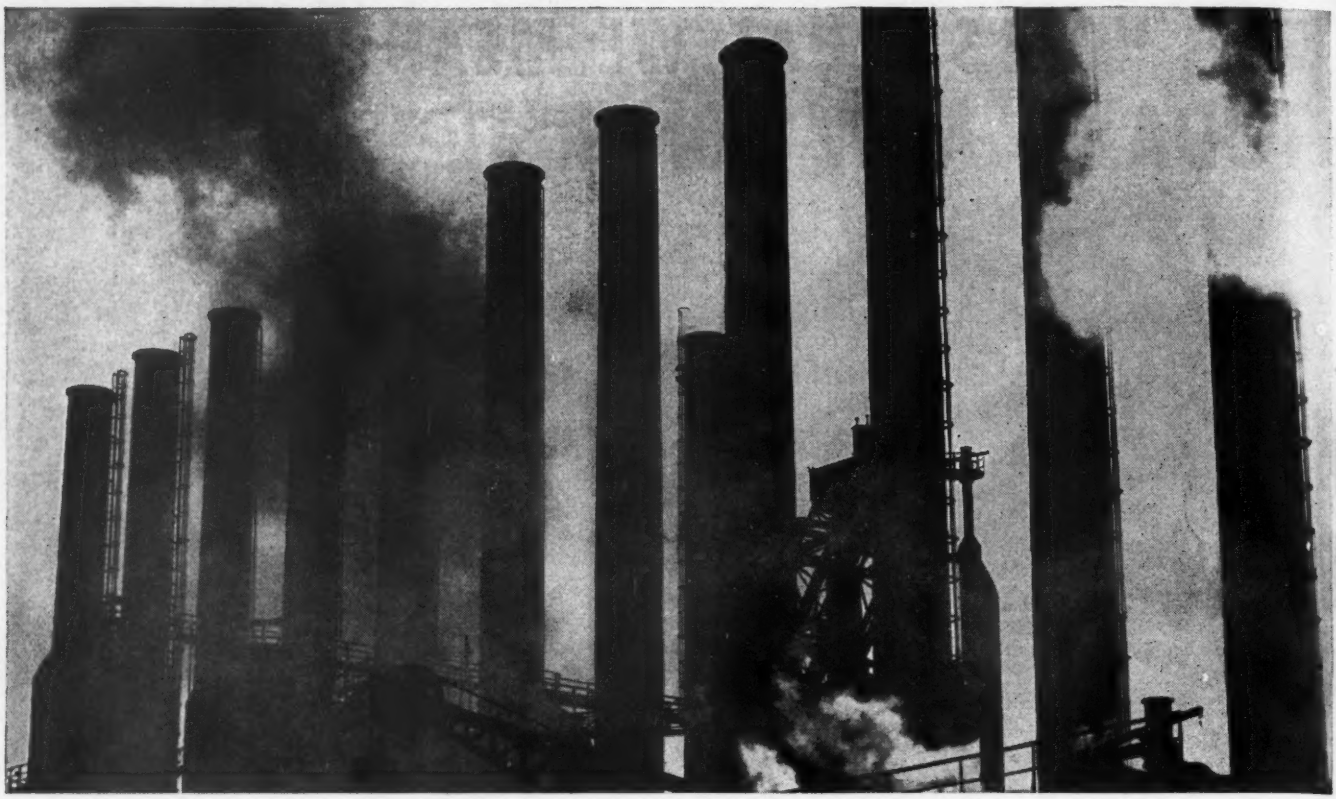

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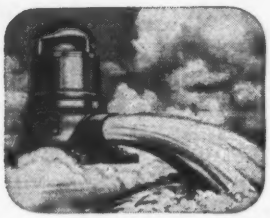

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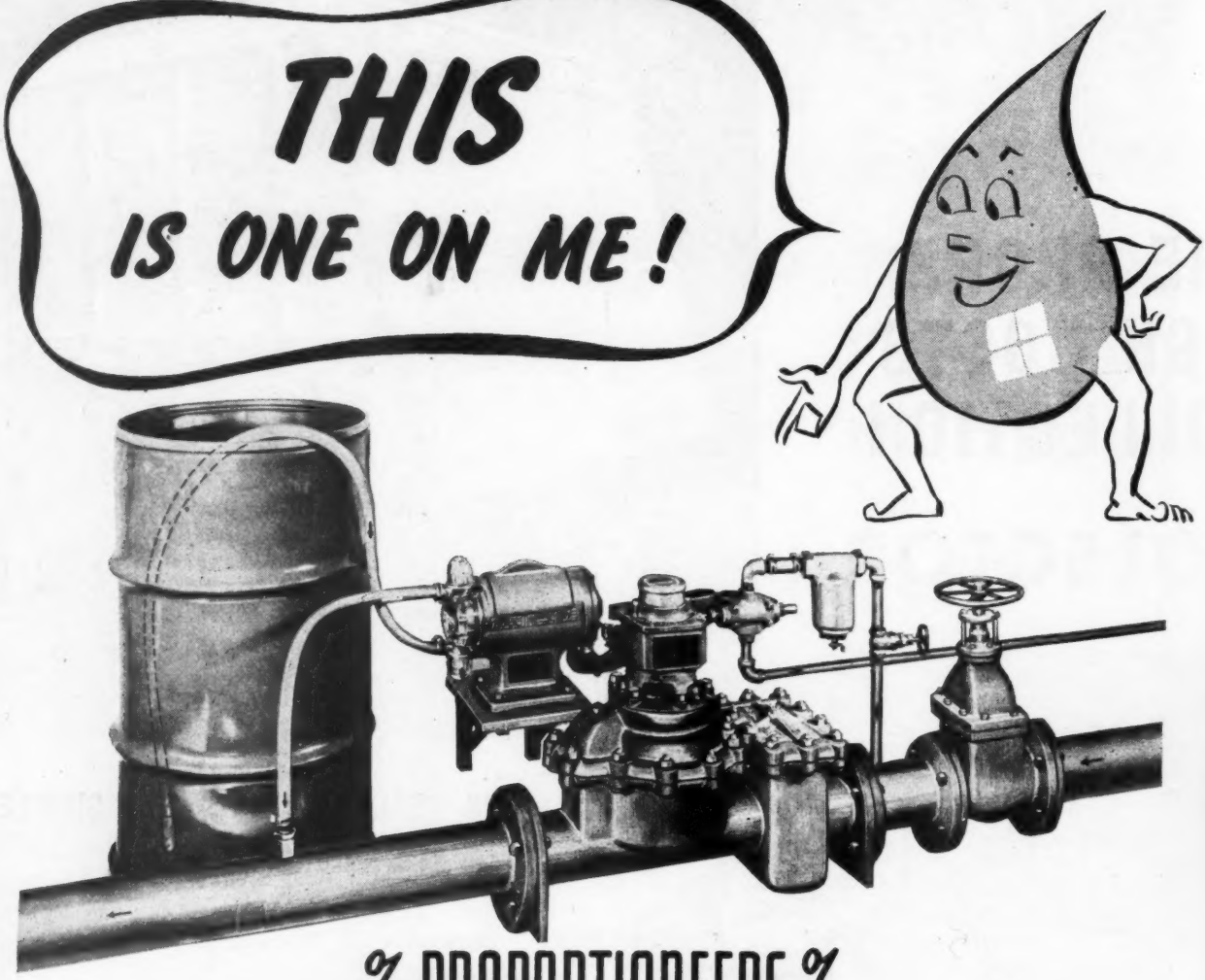
KOLECTOR

IT'S PRACTICAL . . . IT'S SIMPLE . . . IT'S ECONOMICAL . . .

Elimination of heavy truck equipment and maintenance expense is the immediate result of using the Dempster-Dumpster system. Shown above is one of the multiple Kolector bodies. When filled, Dempster-Dumpster Hoisting Unit picks up body, as shown at left, places it in carrying position, see circle, and at rubbish disposal point, dumps load, all three operations being controlled entirely from driver's seat.

YOUR WATER SUPPLY SAYS··

THIS IS ONE ON ME!



%PROPORTIONEERS%

HYDRAULICALLY OPERATED CHEM-O-FEEDER MAKES YOUR WATER SUPPLY TREAT ITSELF··

It's a neat trick and it works! The Automatic and Proportional Chem-O-Feeder utilizes power from the water supply itself to inject reagents into the line and determine its own rate of feed. Paced by meter, it starts, varies, and stops dosage as the water comes on, fluctuates or tapers off. With %Proportioneers% equipment your water supply will solve its own treating problem . . . prevent dangerous undertreatment or disagreeable taste resulting from wasteful overtreatment. Better water quality due to *accurate* and continuous treatment makes the cost of %Proportioneers% equipment nominal.

Precise chemical feeding is an old story to %Proportioneers%—in over 20,000 installations %Proportioneers% equipment is proving reliable, economical and accurate. Your water supply deserves the best—investigate %Proportioneers%!

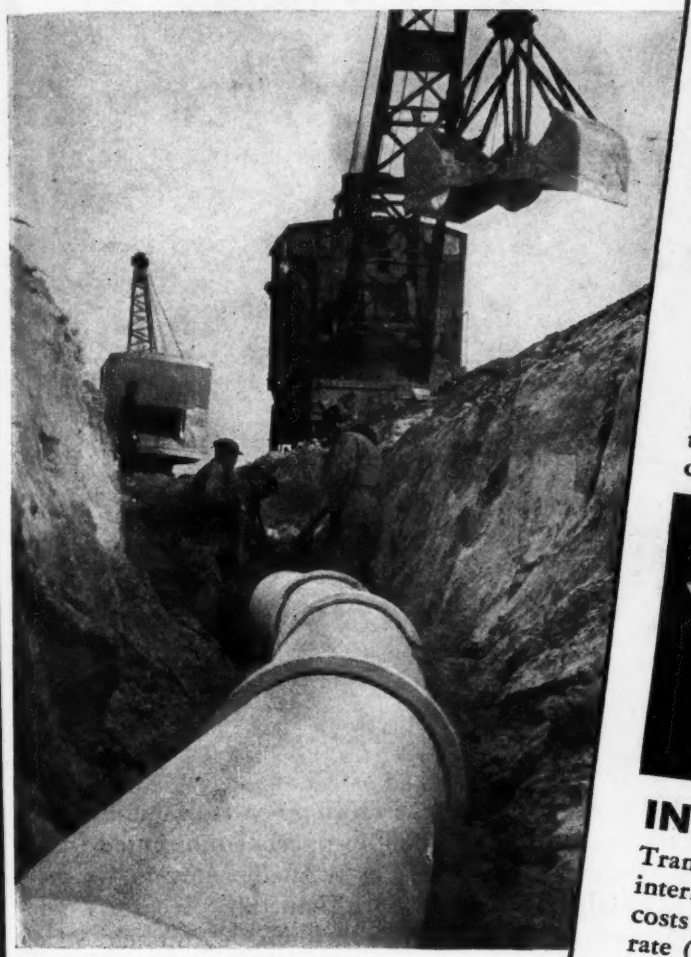
Send for Bulletins.

%PROPORTIONEERS, INC.%

96 CODDING STREET, PROVIDENCE 1, R. I.

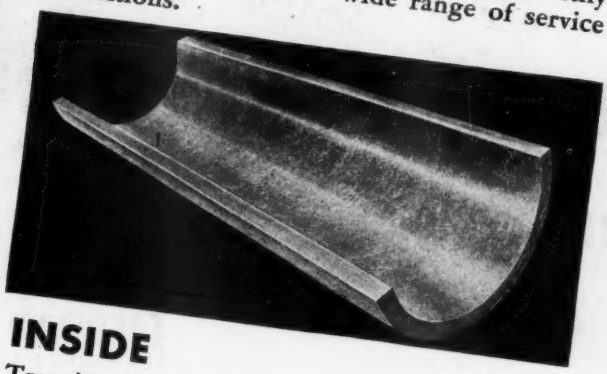
When you need special information—consult the classified* READER'S SERVICE DEPT., *pages 71-73

IT RESISTS CORROSION



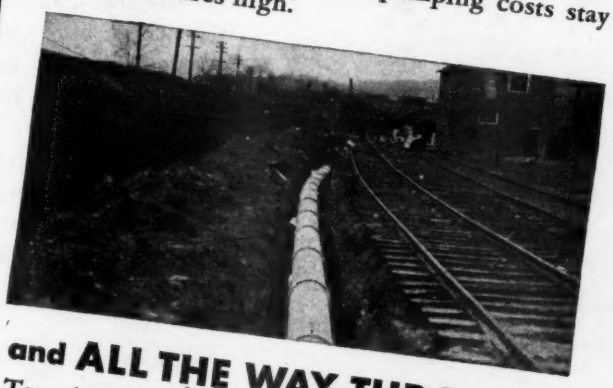
OUTSIDE

Transite Pipe is stubbornly resistant to soil corrosion. Thousands of successful installations, many of them in highly corrosive soils, testify to its stability under a wide range of service conditions.



INSIDE

Transite Pipe cannot tuberculate. This costly internal corrosion that increases maintenance costs can never choke off its initial high flow rate (C=140). As a result, pumping costs stay low, pressures high.



and ALL THE WAY THROUGH

Transite Pipe resists destructive attack. Made of asbestos and cement bonded together under great pressure, its ability to provide efficient, economical water transportation has been proved in thousands of installations.

EASY HANDLING is an additional advantage of Transite Pipe. Its light weight means more footage carried per truck load, fewer men required for handling, lower transportation costs. And in the trench, the Simplex Coupling assures quick, easy assembly, even with inexperienced crews.

For full details, write Johns-Manville, 22 East 40th Street, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE PIPE

FOR EFFICIENT, ECONOMICAL WATER TRANSPORTATION

Reductio ad absurdum

REDUCED to absurdity . . . a two inch pipe with a one-half inch capacity . . . all because of improperly conditioned water. Removing the causes of such costly inefficiency is Graver's business . . . and has been for more than thirty years. We design, build, and install water conditioning equipment of all types that will insure maximum efficiency regardless of the condition of the raw water. Graver provides a complete service, from the laboratory analysis of the raw water through design, engineering, and manufacture of the equipment to installation and operation. We assume undivided responsibility for the entire job.

No matter what the application . . . whether it's the removal of hardness, deaeration, demineralization, filtration, clarification . . . you'll find it to your advantage to consult Graver. Write us today. We'll gladly discuss your water conditioning problems with you and supply detailed information and illustrated bulletins.

There's a Graver representative as near as your telephone

GRAVER

WATER CONDITIONING EQUIPMENT

Process Equipment Division of

GRAVER TANK & MFG. CO., INC.

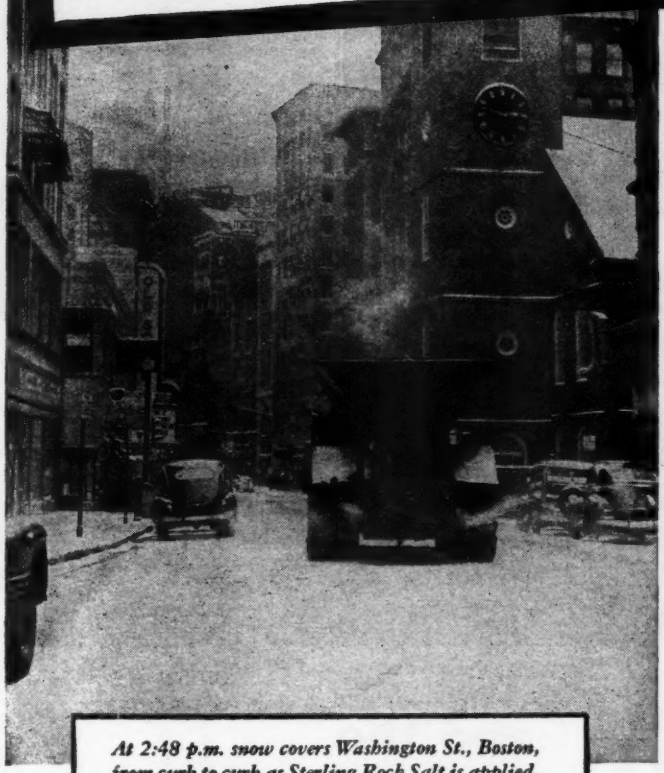
General Offices: 4809-39 Tod Ave., East Chicago, Indiana

NEW YORK CHICAGO CATASAUQUA, PA. TULSA, OKLA.
PHILADELPHIA PORT ARTHUR, TEX.
EXPORT DEPT.: 424 MADISON AVE., NEW YORK, N. Y.

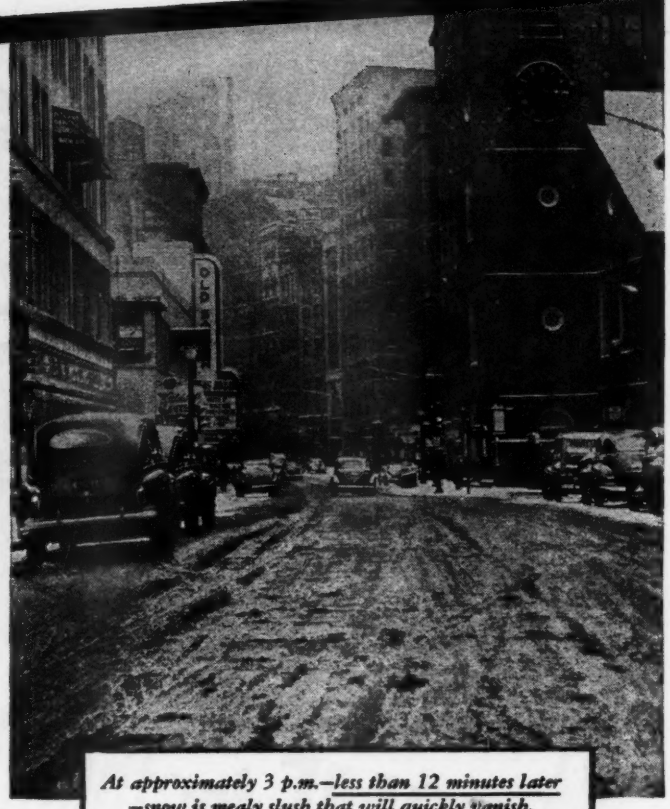
Hot Process Water Softeners • Zeolite Water Softeners Water Filters • Taste and Odor Removal Filters • Iron Removal Filters • Oil Removal Filters • Chemical Mixing and Proportioning Equipment • Demineralizers

When writing, we will appreciate your mentioning **PUBLIC WORKS**

To Remove Snow and Ice—They "PASS the SALT"



At 2:48 p.m. snow covers Washington St., Boston, from curb to curb as Sterling Rock Salt is applied.



At approximately 3 p.m.—less than 12 minutes later —snow is mealy slush that will quickly vanish.

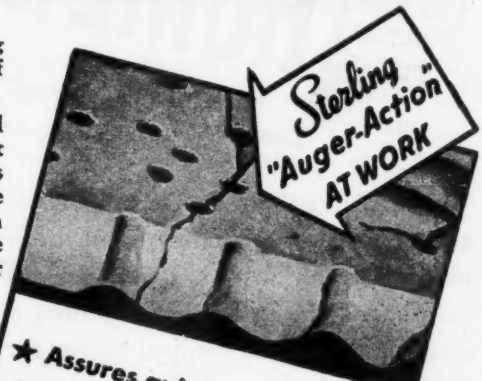
SNOW-CLOGGED highways and ice-glazed streets this winter offer public officials two choices:

"Treating" the snow or ice with abrasives . . . consuming much time, labor and equipment, and accomplishing only temporary results.

OR—*quick and effective removal of such wintry hazards . . . with Sterling Rock Salt!*

Spread when a storm strikes, Sterling Rock Salt prevents sleet and snow from bonding . . . keeps it mealy and easily whipped off to the sides by traffic action.

When snow is packed and ice is formed . . . Sterling "Auger-Action" Rock Salt bores through the largest masses . . . forms a brine which loosens the bond with the pavement . . . the shattered chunks broken by passing traffic are easily removed . . . the remaining brine will prevent any further formation of ice.



★ Assures quick removal
★ Saves labor and equipment
★ Makes driving safe

Sterling
Auger-Action
ROCK SALT

Get the full facts in new FREE booklet!

INTERNATIONAL SALT CO., INC.
Dept. PW-12, Scranton, Pa.

To do an efficient *removal* job with utmost economy . . . just fill in this coupon and mail it today for your *free* copy of "WHY, WHEN AND HOW TO APPLY STERLING 'AUGER-ACTION' ROCK SALT."

*Name*_____
*Title*_____
*Street*_____
*City*_____ *State*_____

INTERNATIONAL SALT COMPANY, INC. • SCRANTON, PA.

When you need special information—consult the classified READER'S SERVICE DEPT., pages 71-73

HOME for them!

and the HOME STRETCH for YOU!

You still have time! In December, your employees' allotments to the Victory Loan through your company's Payroll Savings Plan offer a final chance to help speed the proud homecoming of our fighting men—and do all in medical power for our hospitalized heroes!

Make December a plantwide TOP-THE-QUOTA drive! Now's the time to spotlight your Payroll Savings Plan—and "brief" your Bond-selling organization for fast, last minute action!

***Resolicit every employee to buy the* New F.D.R. Memorial $200 Bond**

The new Franklin Delano Roosevelt $200 Bond—better than actual cash because it earns interest—is a strong building stone toward the secure future of every employee-purchaser!

From now 'til the New Year—with plant rallies, interdepartmental contests and resolicitation—keep Payroll Savings Plan Bond-buying at a new Victory Loan high! Buying a Victory Bond is the best way of saying "Welcome Home" to our returning veterans! Also an active aid in assuring prosperity to your nation, your employees—and your own industry!

VICTORY LOAN

The Treasury Department acknowledges with appreciation the publication of this message by

PUBLIC WORKS Magazine

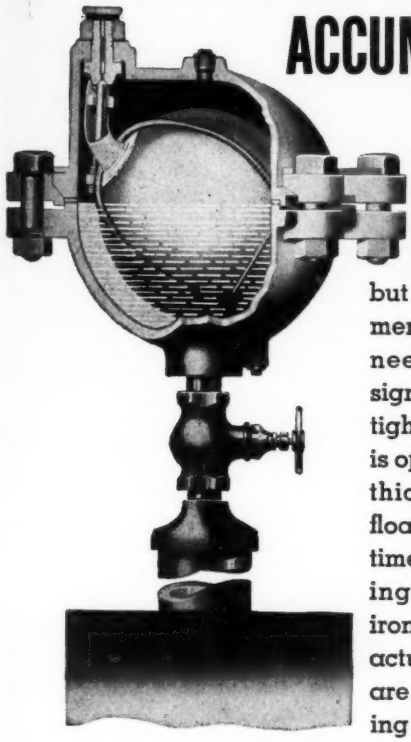
This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and War Advertising Council

When you need special information—consult the classified READER'S SERVICE DEPT., pages 71-73

IS AIR SABOTAGING YOUR PIPE LINES AND PUMPS?

If not removed, air entrained in a liquid or entering the system through leaky joints and pump suctions, may result in serious damage to the pipe line and to the pumping equipment. These air obstructions not only reduce the operating head, but the area of discharge is considerably reduced or entirely cut off.

SIMPLEX AIR RELEASE VALVES AUTOMATICALLY VENT AIR ACCUMULATIONS



THE Simplex Automatic Air Release Valve is of simple, dependable construction, having but one lever movement which operates a needle valve so designed as to be always tight seating. The valve is operated by a heavy thickness glass ball float, tested to several times the service working pressure. A cast iron shell houses the actuating parts which are of corrosion resisting materials.

Standard Simplex Air Release Valve is for working pressures up to 250 lbs. per square inch. The Type "ARA" valve is similar in design but operates up to 1250 lbs. per square inch. Simplex Air Release Valves are being used extensively on lines and pumps for the release of air in water and sewage lines, oil and gasoline lines, and for industrial process liquids.

Write today for further information on the Simplex Air Release Valve — the automatic watchdog to assure continuous peak flow.

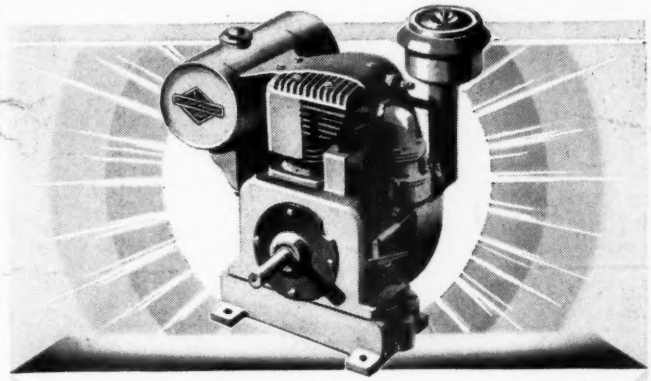
SIMPLEX VALVE & METER COMPANY
6730 Upland Street • Philadelphia, Pennsylvania

• • • POWER WITH • • •

BRIGGS & STRATTON

Air-Cooled Engines

YOUR ASSURANCE OF MAXIMUM PERFORMANCE

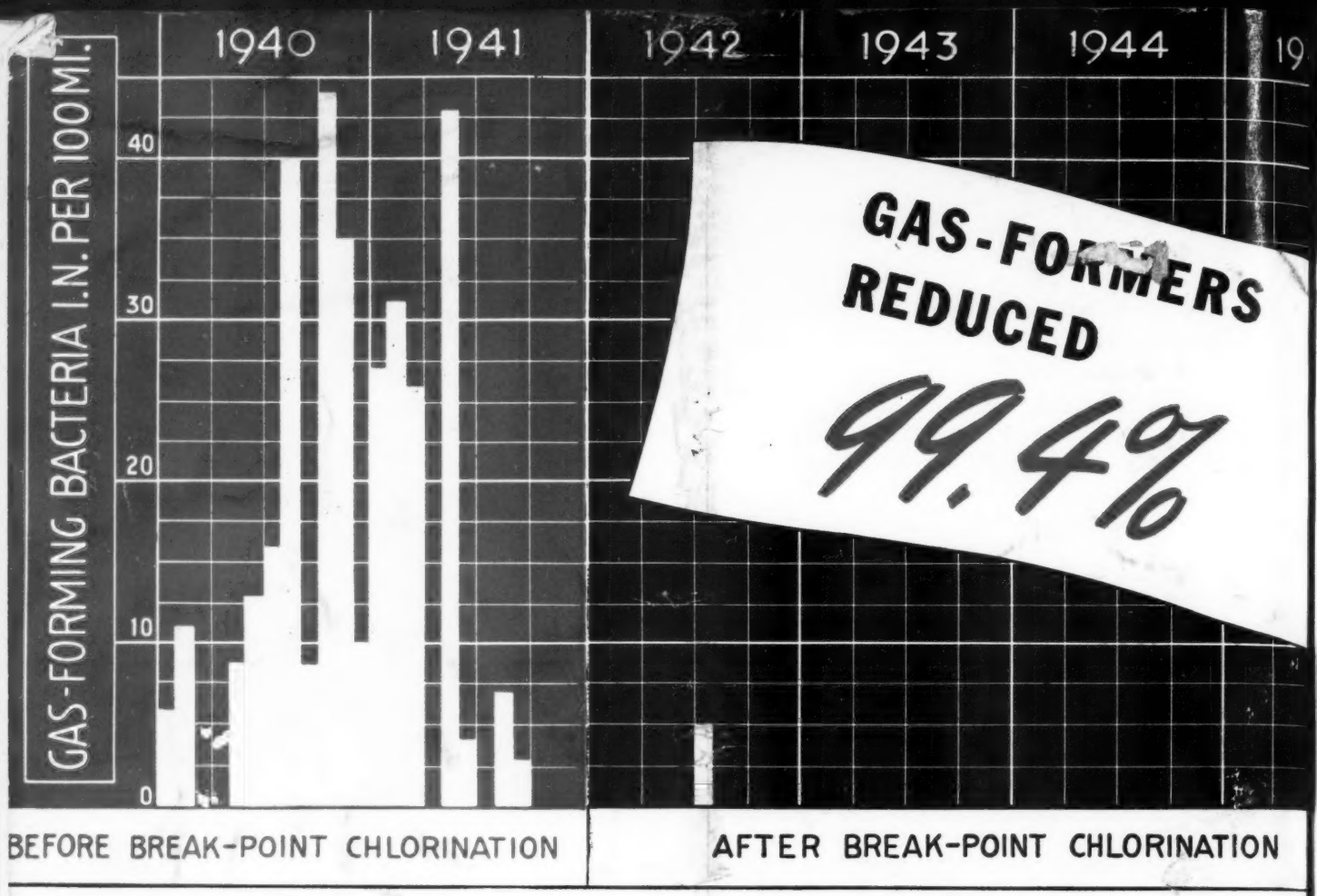


In a brilliant record of dependable, economical operation—well above 2¼ MILLION Briggs & Stratton 4-cycle gasoline engines have *earned undisputed* recognition as "preferred power" the world over. Current models are the result of skill and experience gained during more than 26 years of *continuous production*—and constant advancements in design and precision manufacture. These distinctive Briggs & Stratton advantages are your assurance of *maximum performance*—whether you build, sell, or use gasoline-powered appliances, machinery, or industrial equipment.

BRIGGS & STRATTON CORPORATION
Milwaukee 1, Wis., U. S. A.

Air-Cooled Power

4 CYCLE
BRIGGS & STRATTON
GASOLINE ENGINES



River water made "extra safe" by BREAK-POINT CHLORINATION

Actual records for a community that now has one of the nation's "extra safe" water supplies are shown in the chart above.

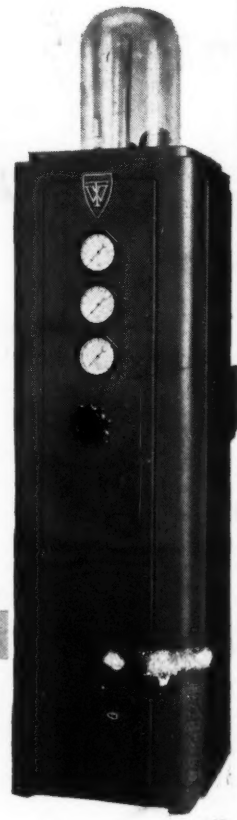
Sharp and consistent reductions in gas-formers were achieved with the adoption of Break-Point Chlorination. Odor difficulties were eliminated as well, when chlorine dosage was increased from 1.75 ppm to 2.84 ppm.

This community is one of many throughout the nation whose experience has proved that a *free available chlorine residual*, maintained by Break-Point Chlorination, gives SAFETY-PLUS. These communities have blazed the way to new water treatment standards.

Your W&T Representative can apply up-to-date Break-Point experience to your problem of giving your citizens a safer more palatable water.

BACTERIOLOGICAL DATA

	MARGINAL CHLOR.	B-P CHLOR.	CHANGE
Total Bact. per ml (Average)	78.	8.3	—89.3%
Indicated Number Gas-forming Organisms per 100 ml—Filtered Water	4.06	0.022	—99.4%



SA-193

"THE ONLY SAFE WATER IS A STERILIZED WATER"

WALLACE & TIERNAN COMPANY, INC.

MANUFACTURERS OF CHLORINE AND AMMONIA CONTROL APPARATUS
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES